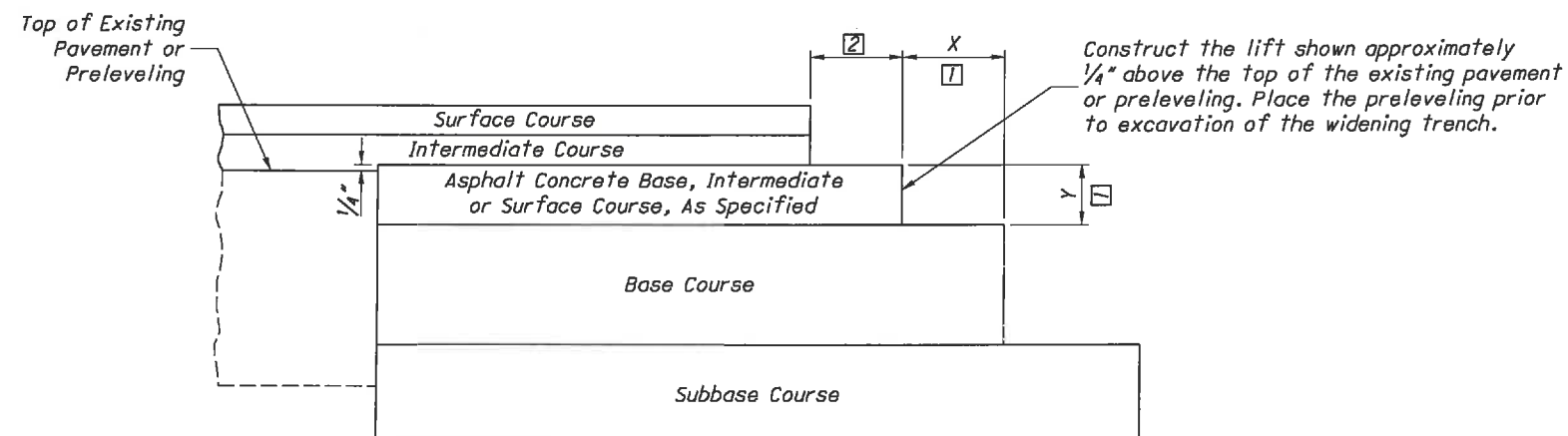
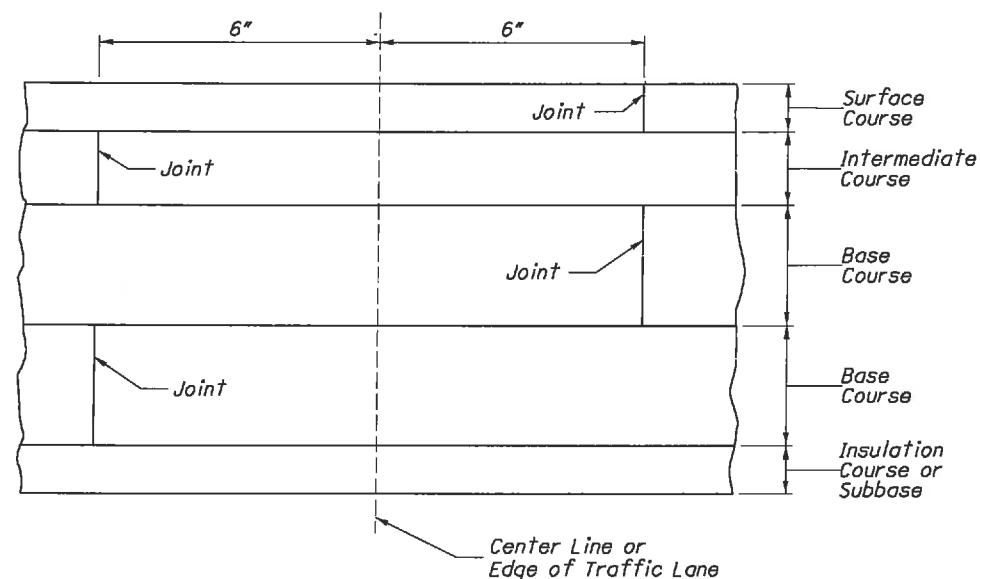


PLAN
MERGING EDGE OF PAVEMENT WIDENING
WITH EDGE OF EXISTING PAVEMENT



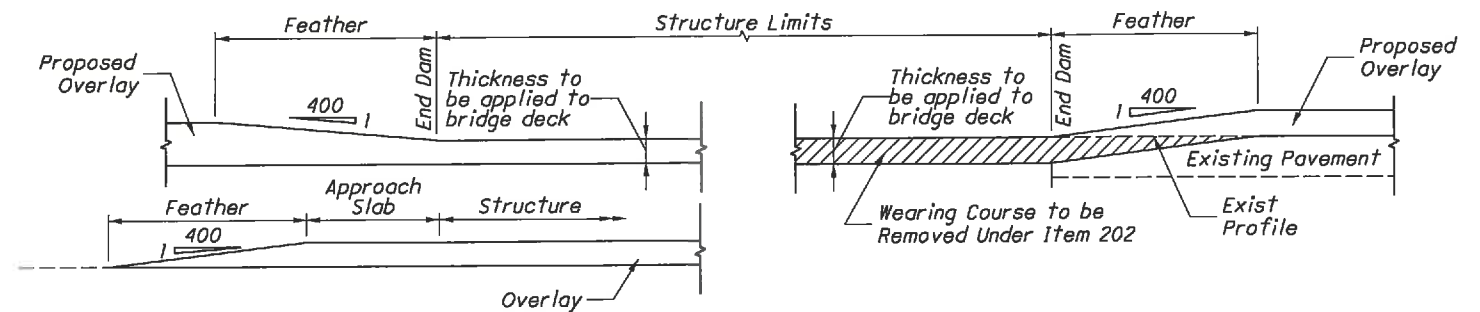
SECTION A-A
COURSE DETAIL FOR WIDENING



Lapping Longitudinal Joints

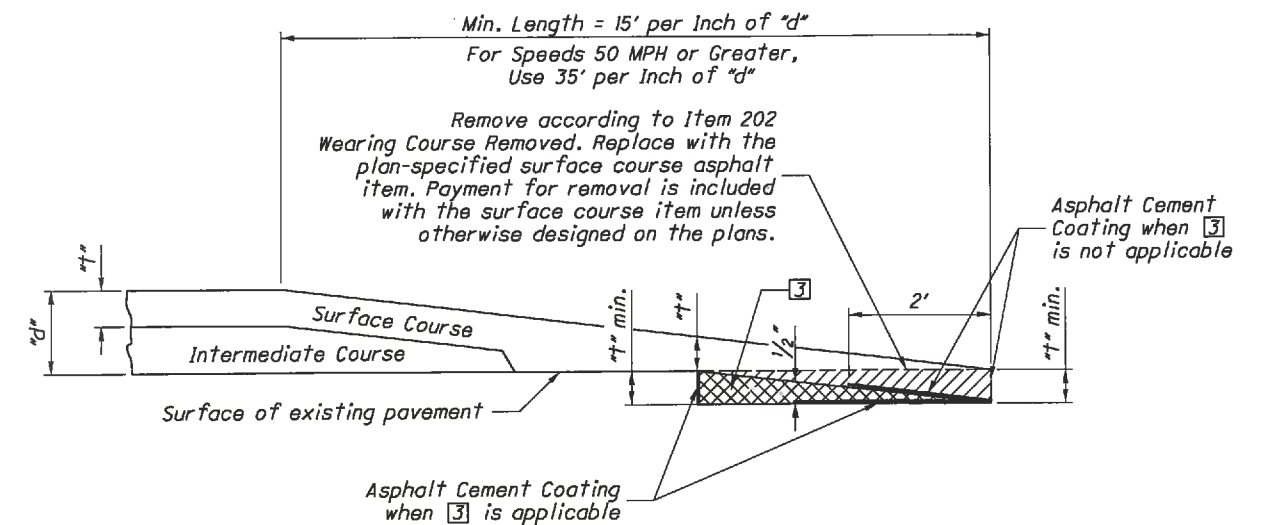
LEGEND

- 1 The extended width (X) of a base or subbase lift shall be equal to the depth (Y) of the overlying lift or 6", whichever is greater, or as shown on the plans.
- 2 The extended width shall be equal to the combined thickness of the surface and intermediate courses, or 4", whichever is greater.
- 3 Permissible removal and replacement

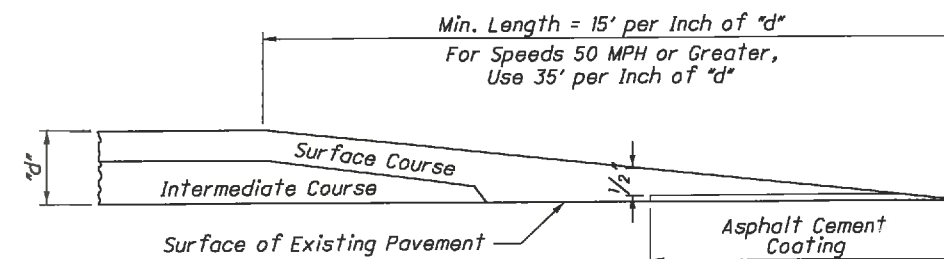


Details assume non-settled approach slabs. Smoothing of the profile for Settlement is required per plan grades or as directed by the Engineer.

FEATHERING AT STRUCTURES



BUTT JOINT TYPE

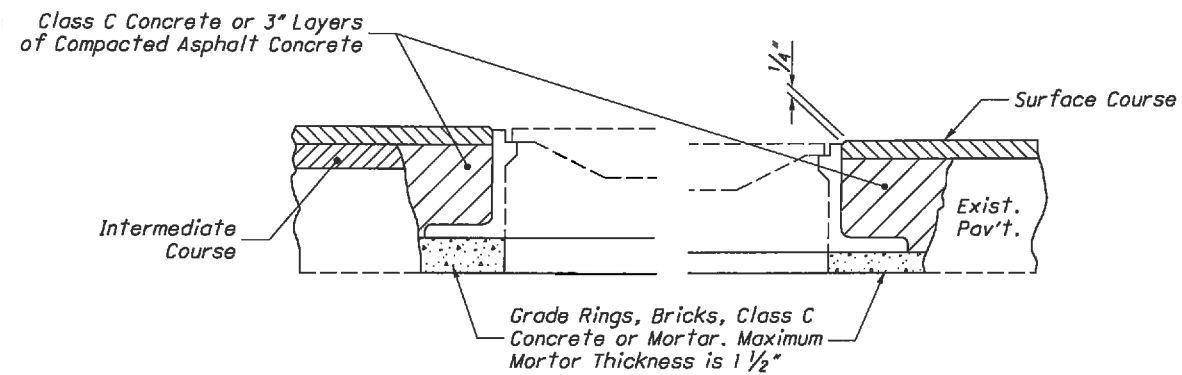


TAPER EDGE TYPE

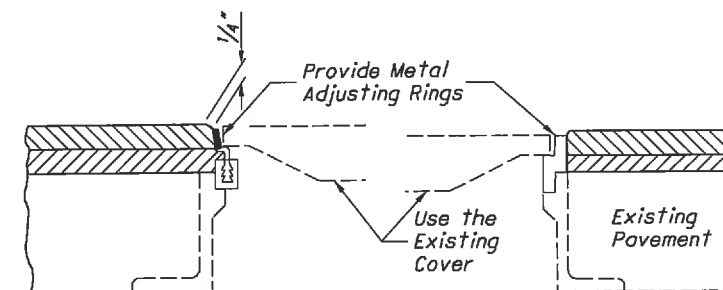
NOTE: Butt joint is required unless the taper edge is specified in the plans or approved by the Engineer.

PLACING FEATHERED AREAS

Values for "t" and "d" are obtained from the plan.



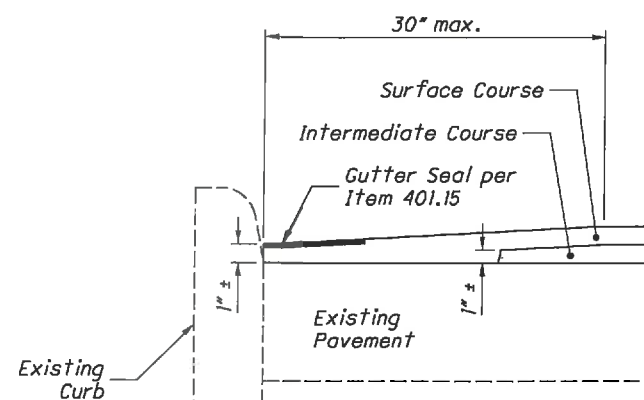
USING CONCRETE OR MORTAR



USING METAL ADJUSTING RINGS

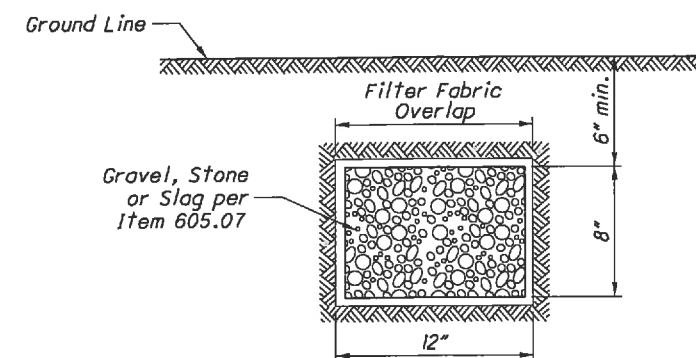
Metal adjusting rings shall:
 (a) Attach securely to the existing frame by welding or mechanical devices;
 (b) Consist either of cast metal having an integral rim and seat, or be fabricated metal with a sturdy connection between the seat and rim; and
 (c) Provide an even seat for the manhole cover.
 In addition, the adjusting ring type shall be a design acceptable to the local governmental agency responsible for street and sewer maintenance. Any installation unacceptable to the Engineer shall be replaced by the Contractor at his expense.

MANHOLES ADJUSTED TO GRADE



Special care shall be taken during construction to obtain maximum compaction of asphalt concrete in gutters.

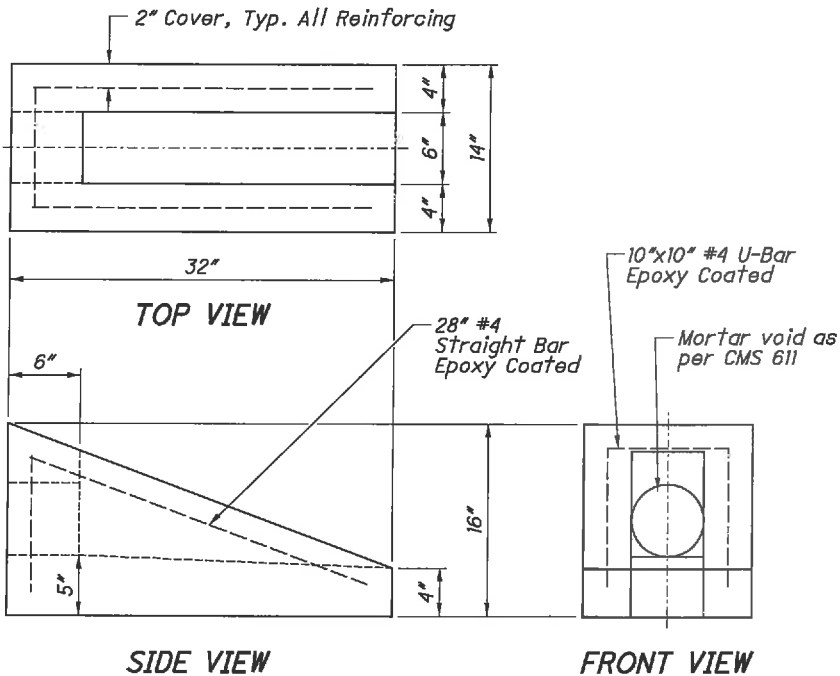
GUTTER FINISH



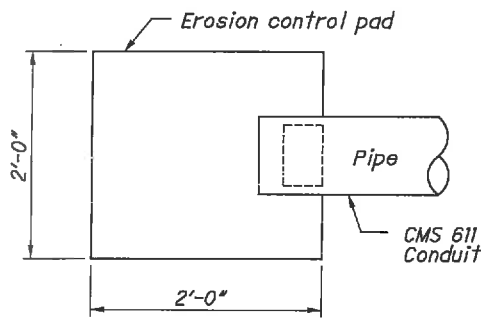
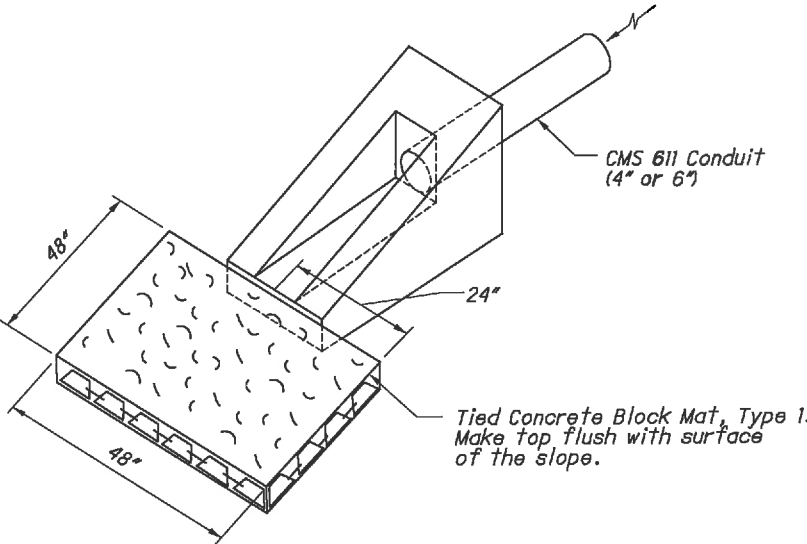
Aggregate drains to be placed where and as directed by Engineer. Provide Filter Fabric when specified as a separate pay item.

AGGREGATE DRAIN

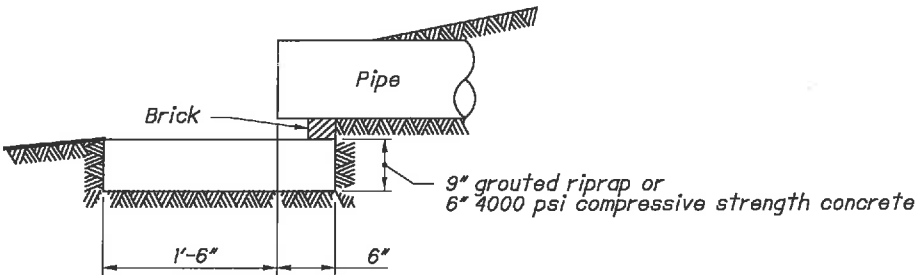
CONSTRUCTION METHODS



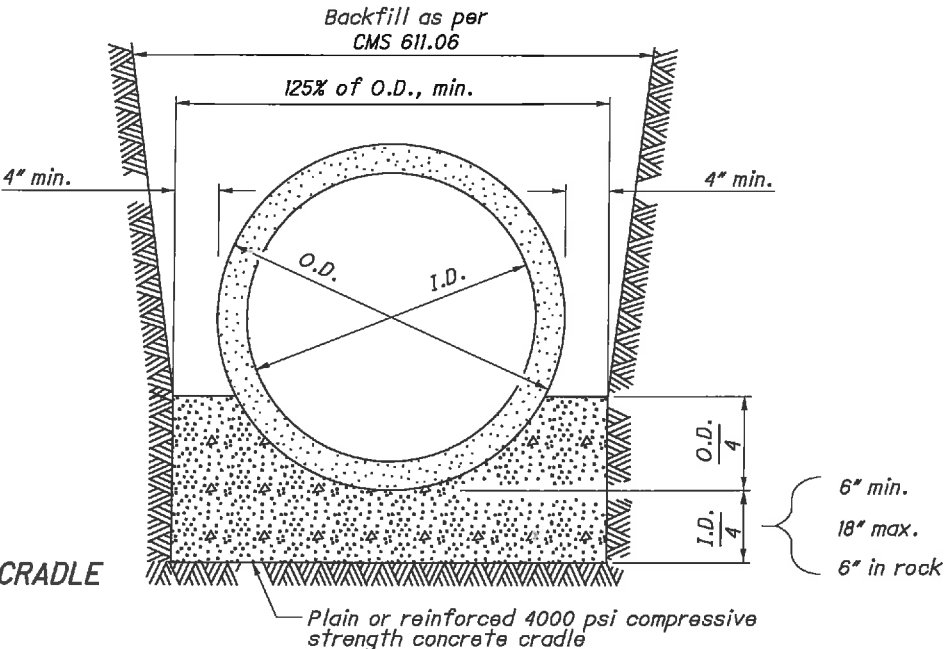
PRECAST REINFORCED CONCRETE OUTLET



EROSION CONTROL PAD FOR OUTLET PIPE



PROFILE



CONCRETE CRADLE

NOTES

EROSION CONTROL PAD: Provide erosion control at the outlet of all farm drains except where they outlet into a drainage structure.

PAYMENT: Erosion control pads are included in the unit price bid for Item 611 - -- Inch Conduit, Type -- .

PRECAST REINFORCED CONCRETE OUTLET: Provide a concrete outlet that meets CMS 611 requirements.

PAYMENT: The precast reinforced concrete outlet are paid at the contract unit price bid for Item 611 - Precast Reinforced Concrete Outlet.

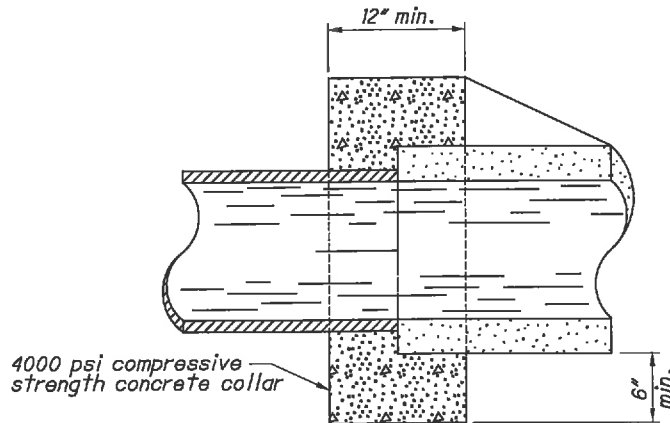
Tied Concrete Block Mat, Type 1 is paid at the contract unit price bid for Item 601 - Tied Concrete Block Mat, Type 1.

SPRING DRAIN: Aggregates, tarred paper, tarred burlap, or geotextile fabric backfill and necessary excavation for spring drains are included for payment in the unit price bid per Foot for Item 605 - Aggregate Drains for Springs.

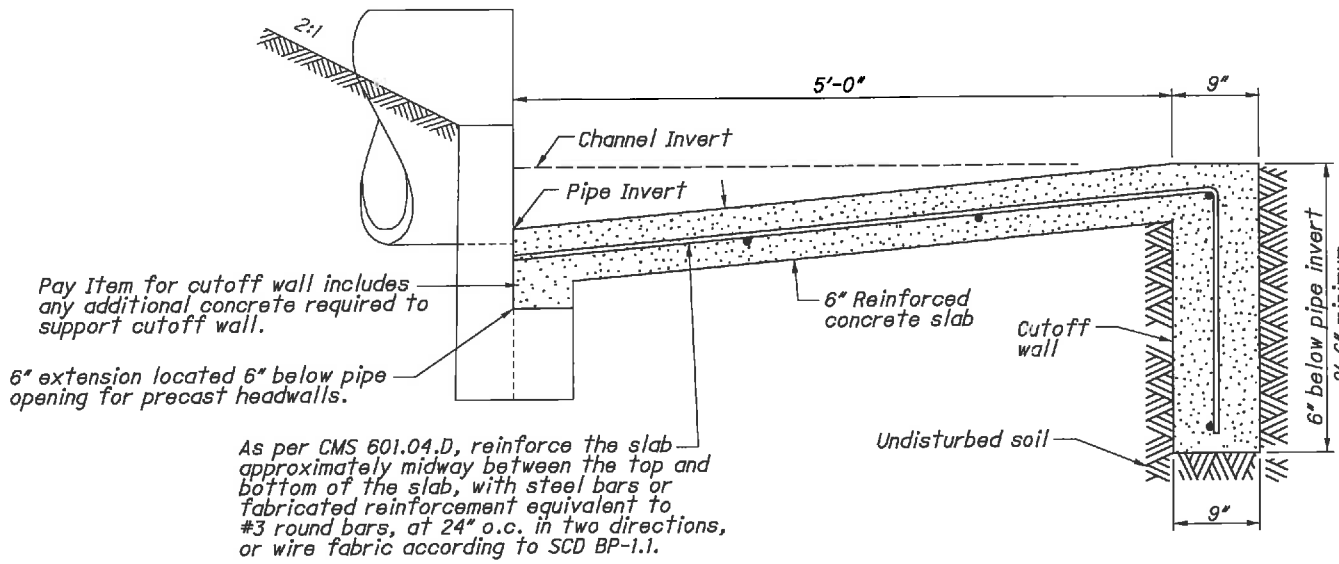
PAYMENT: The pipe is included in the unit price bid per Foot for Item 605 - 6" Unclassified Pipe Underdrains for Springs.

MASONRY COLLARS: Provide a masonry collar where plans require that a pipe extension be joined to the end of an existing pipe with a butt joint. The cost is included in the unit price bid for the new conduit.

RIPRAP CUTOFF WALL: The cost of the cutoff wall is included in the unit price bid for Item 601 - Riprap Using 6" Reinforced Concrete Slab.

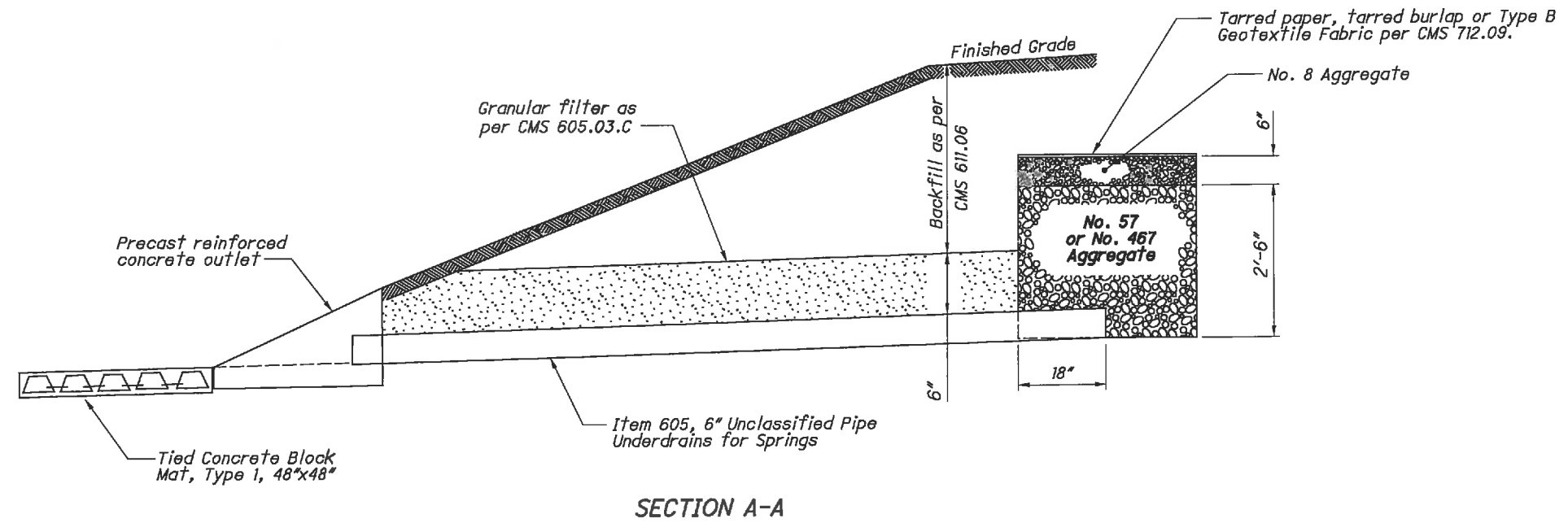
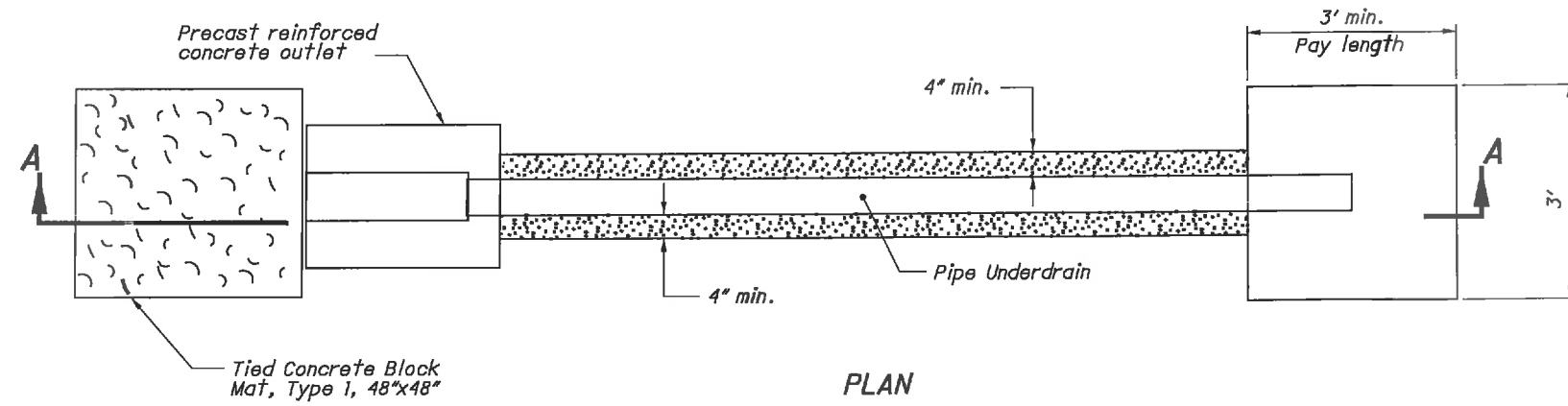


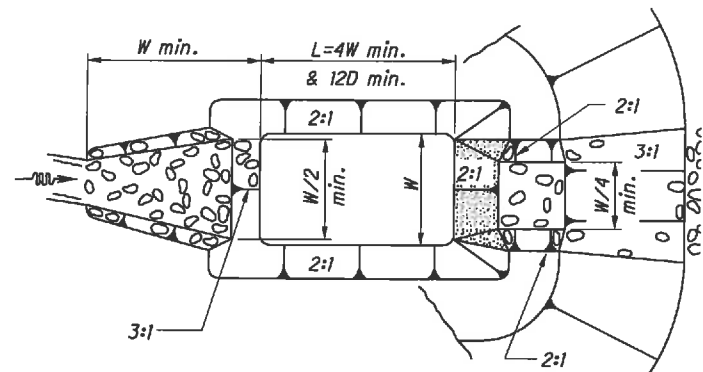
MASONRY COLLAR



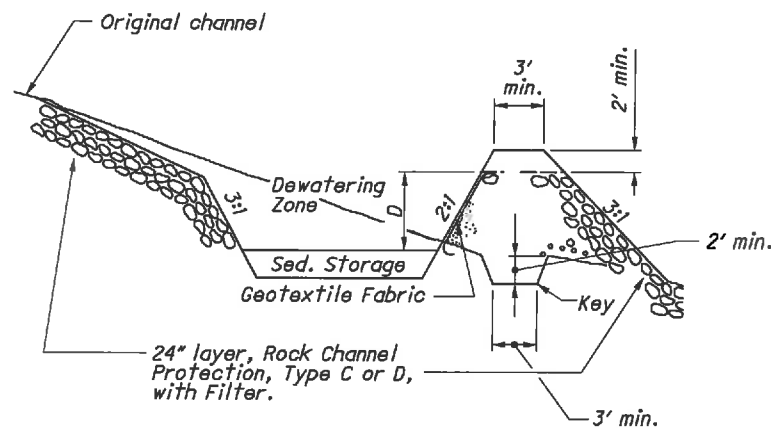
RIPRAP CUTOFF WALL

SPRING DRAIN DETAIL

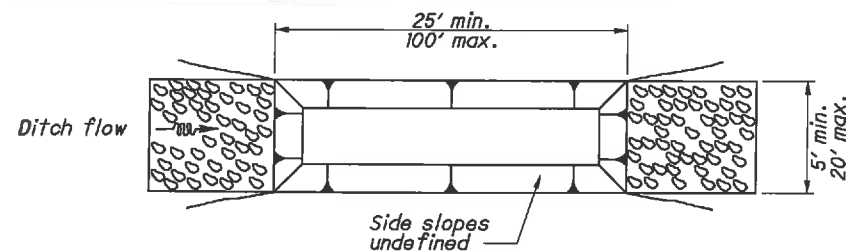




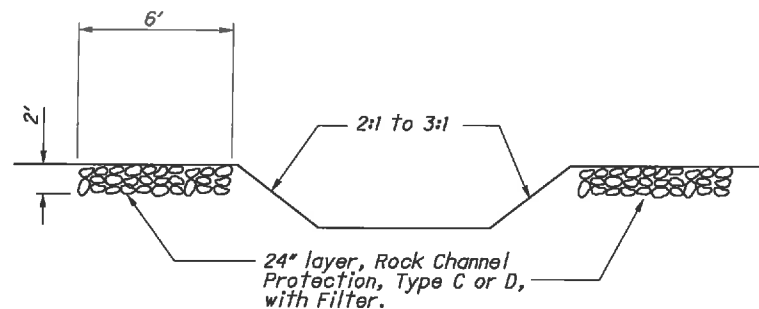
PLAN



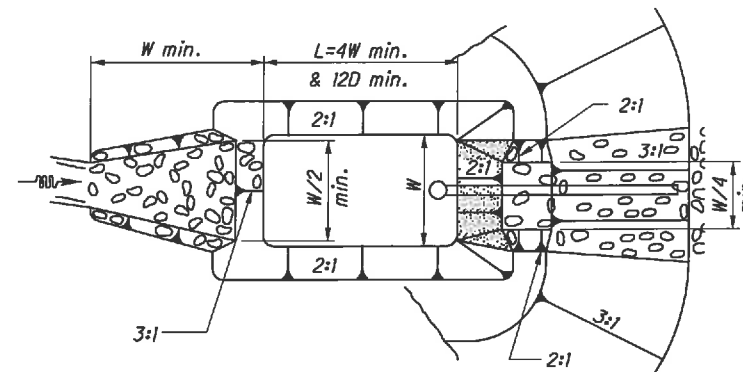
PROFILE
SEDIMENT DAM
(Drainage Area of Less than 5 Acres)



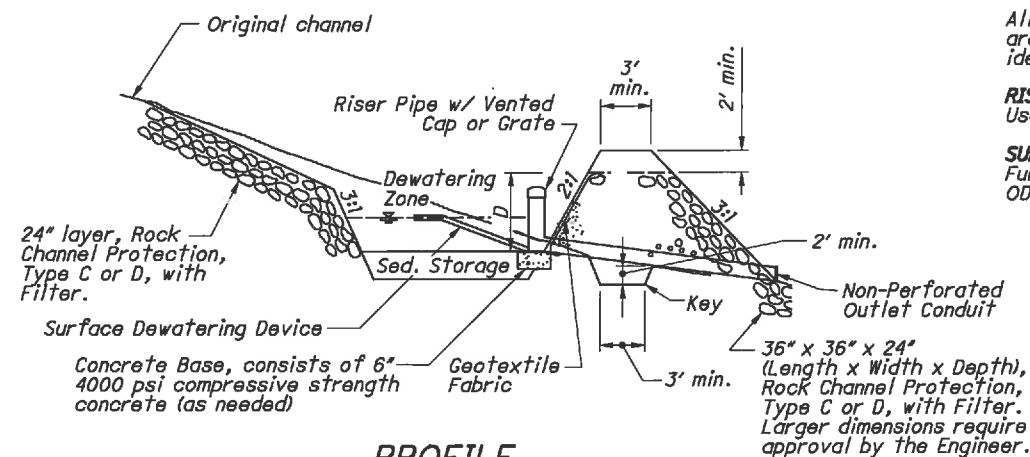
PLAN



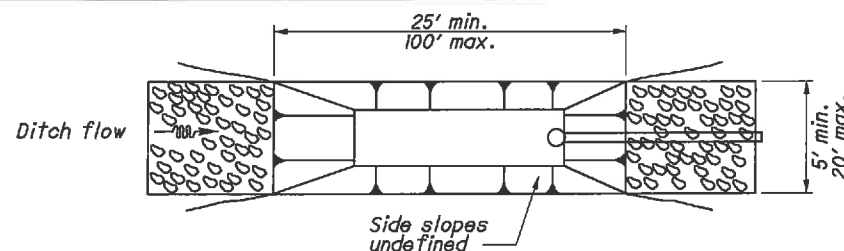
PROFILE
SEDIMENT BASIN
(Drainage Area of Less than 5 Acres)



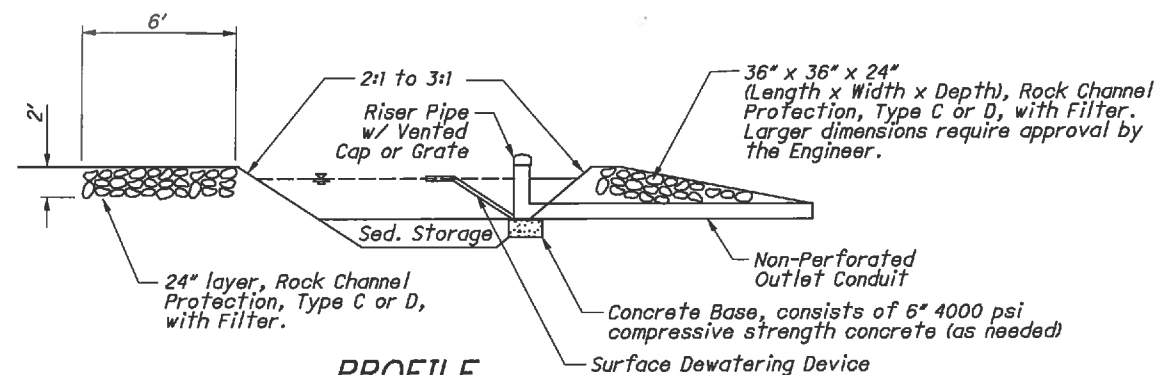
PLAN



PROFILE
SEDIMENT DAM
(Drainage Area of 5 Acres or More)



PLAN



PROFILE
SEDIMENT BASIN
(Drainage Area of 5 Acres or More)

NOTES

MATERIAL:

Furnish materials conforming to Item 203, Embankment, and Item 601, Rock Channel Protection, Type C or D with filter. Furnish construction fence consisting of 4'-0" high plastic fence with 6' long metal fence posts.

CONSTRUCTION:

Construct the Basin and Dams as detailed. Construct the construction fence in urban areas or in high pedestrian traffic areas. Construct the fence to completely surround the sediment basin or dam. Place the fence post on 8' centers, 2' deep. Securely attach the plastic construction fence to the fence post.

PAYMENT:

The Department will pay for accepted quantities at the prices shown in Appendix F of Supplemental Specification 832 (SS832) for the following items:

- Sediment Basins and Dams
- Rock Channel Protection, Type C or D, with Filter

All items shown on this Standard Construction Drawing that are required for construction that are not specifically identified in SS832 Appendix F are considered incidental.

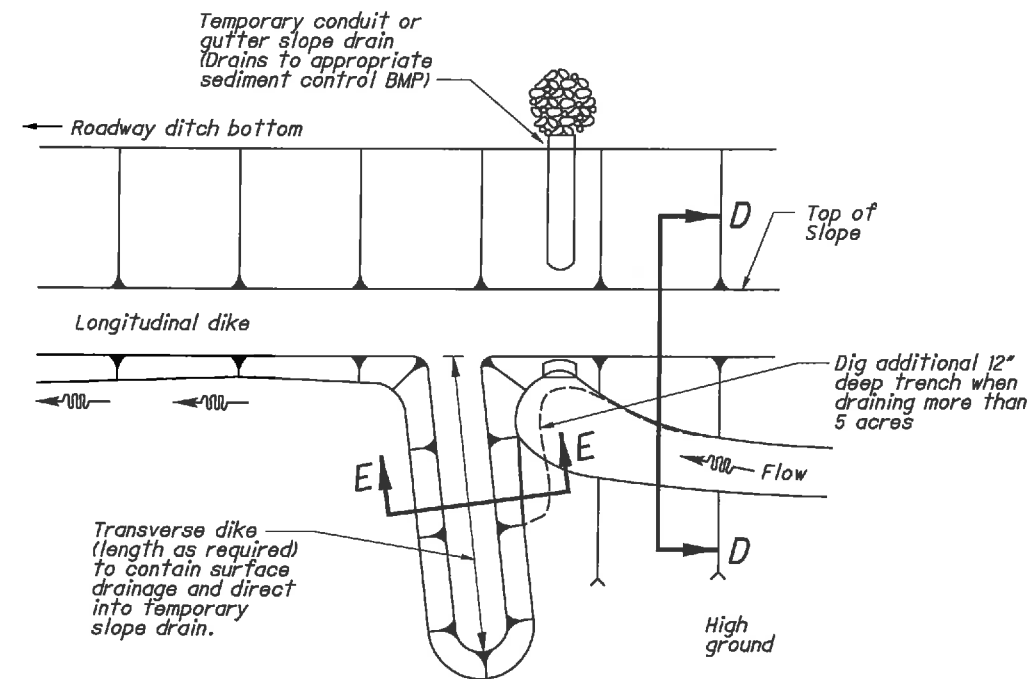
RISER PIPE:

Use schedule 40 Polyvinyl Chloride Conduit.

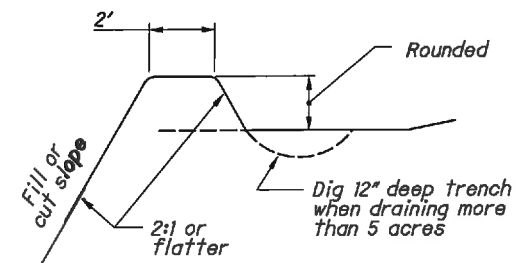
SURFACE DEWATERING DEVICE:

Furnish surface dewatering device as required by the ODN Rainwater and Land Development Manual.

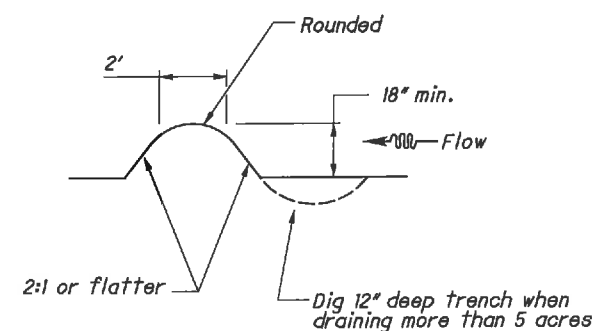
DIKES AND SLOPE DRAINS



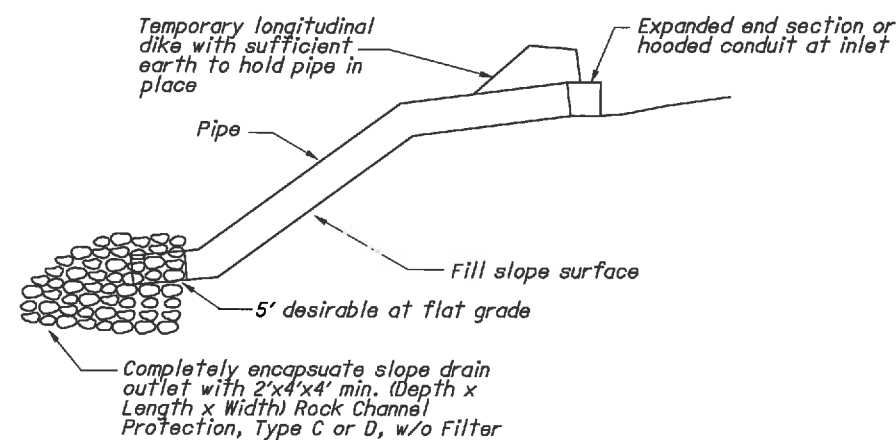
PLAN VIEW



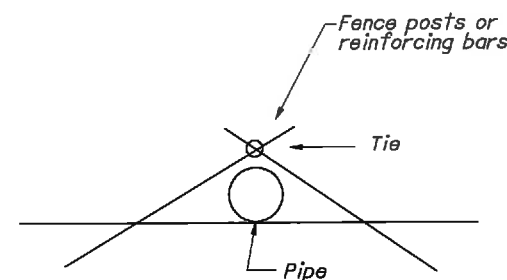
SECTION D-D



SECTION E-E



CONDUIT SLOPE DRAIN



TIE-DOWN SLOPE DRAIN

NOTES

MATERIAL:

Furnish materials conforming to Item 203, Embankment, and Item 601, Rock Channel Protection, Type C or D, without filter.

Furnish the following for the slope drains: corrugated steel pipe, corrugated or smooth plastic pipe, reinforcing bars or fence posts.

CONSTRUCTION:

Construct as detailed. Compact the dike to 85% of Standard Proctor.

Use reinforcing bars or fence posts to tie down the slope drains and to keep the pipe from moving.

Ensure that the water entering the slope drain inlet does not erode or degrade the dike section containing the temporary conduit.

PAYMENT:

The Department will pay for accepted quantities at the prices shown in Appendix F of Supplemental Specification 832 (SS832) for the following items:

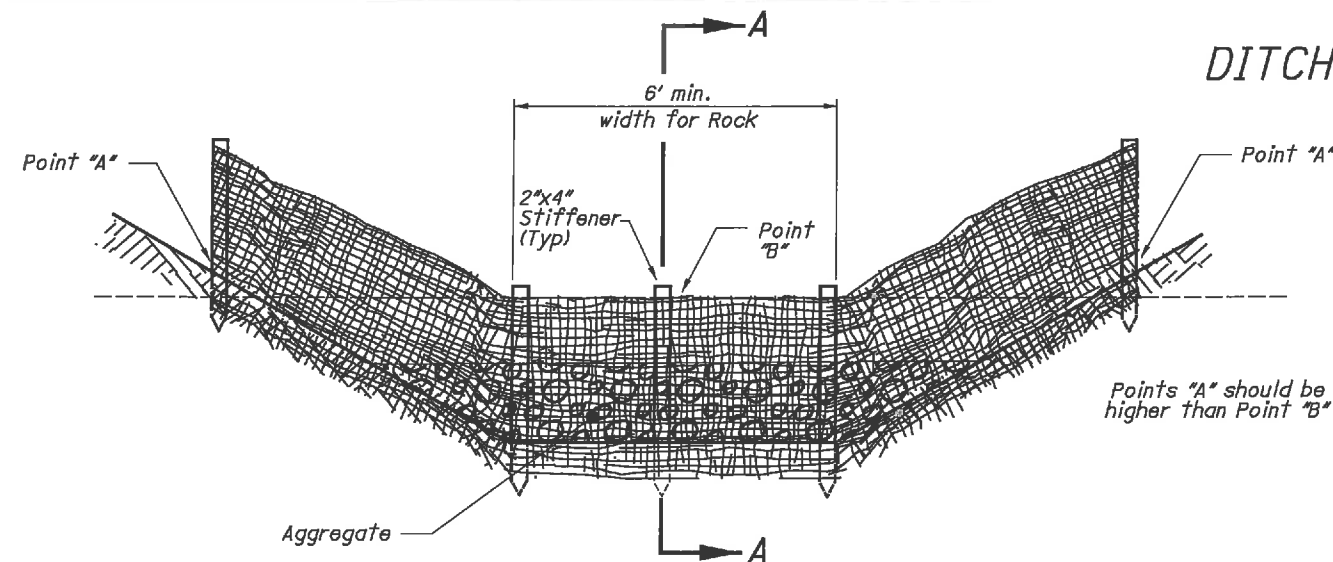
- Slope Drains
- Dikes
- Rock Channel Protection, Type C or D, Without Filter

All items shown on this Standard Construction Drawing that are required for construction that are not specifically identified in SS832 Appendix F are considered incidental.

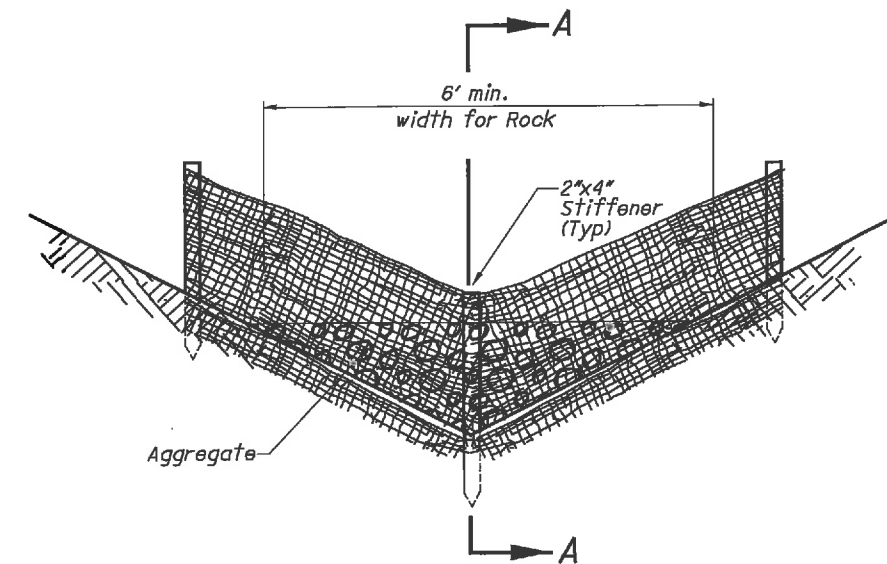
TEMPORARY SLOPE DRAINS RECOMMENDED SIZES

AREA in acres	PIPE SIZES	
	Smooth	Corrugated
0-4	6"	6"
4-8	8"	12"
8-12	10"	15"

DITCH CHECKS



CROSS-SECTIONAL VIEW OF FLAT BOTTOM DITCH



CROSS-SECTIONAL VIEW OF "V" DITCH
NOTES

GEOTEXTILE FABRIC DITCH CHECKS:

MATERIALS:

Furnish geotextile fabric ditch checks consisting of the following materials:

- 30" wide geotextile fabric with sound wood supports with maximum on-center spacing of 10'. Use geotextile fabric conforming to 712.09, Type C.
- A vertically driven 2"x4" stiffener stake in the center of the ditch.
- Aggregate conforming to one of the following gradations: No. 1 through No. 4 on Table 703.01-1.

When using straw bales, furnish 30" long 2"x2" wooden stakes, reinforcing bars or fence posts to stake straw bales in place.

CONSTRUCTION:

Trench the geotextile fabric fence as detailed for PERIMETER GEOTEXTILE FABRIC FENCE (see Sheet 2). Place a vertical 2"x4" stiffener stake in the center of the ditch with the top level to the top of the fence and at least 6" below the bottom of the ditch. Excavate for aggregate and place the aggregate on the downstream side of the ditch check.

If the Engineer determines that rock should not be used for the geotextile fabric ditch checks, replace aggregate with straw bales configured with minimal gaps between bales. Tightly place each bale adjacent to one another. Entrench 2" to 3" into the ground prior to staking. Firmly stake each bale with at least two stakes.

PAYMENT:

The Department will pay for accepted quantities at the prices shown in Appendix F of Supplemental Specification 832 (SS832) for the following items:

- Geotextile Fabric Ditch Check

All items shown on this Standard Construction Drawing that are required for construction that are not specifically identified in SS832 Appendix F are considered incidental.

NOTES

ROCK CHECKS:

MATERIALS:

Furnish material conforming to Item 601 - Rock Channel Protection, Type C or D, Without Filter.

CONSTRUCTION:

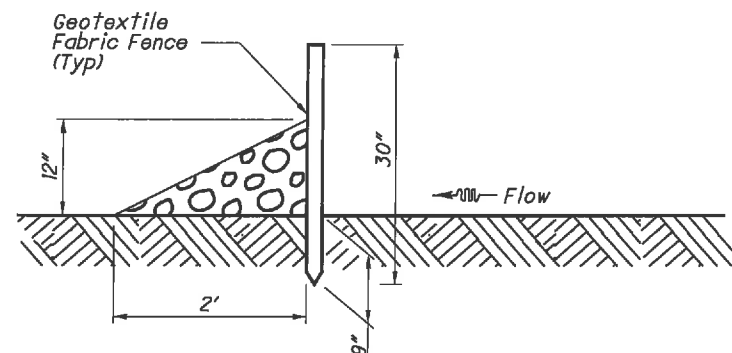
If the Engineer determines that rock should not be used for the rock checks, replace rock channel protection with straw bales configured with minimal gaps between bales. Tightly place each bale adjacent to one another. Entrench 2" to 3" into the ground prior to staking. Firmly stake each bale with at least two stakes.

PAYMENT:

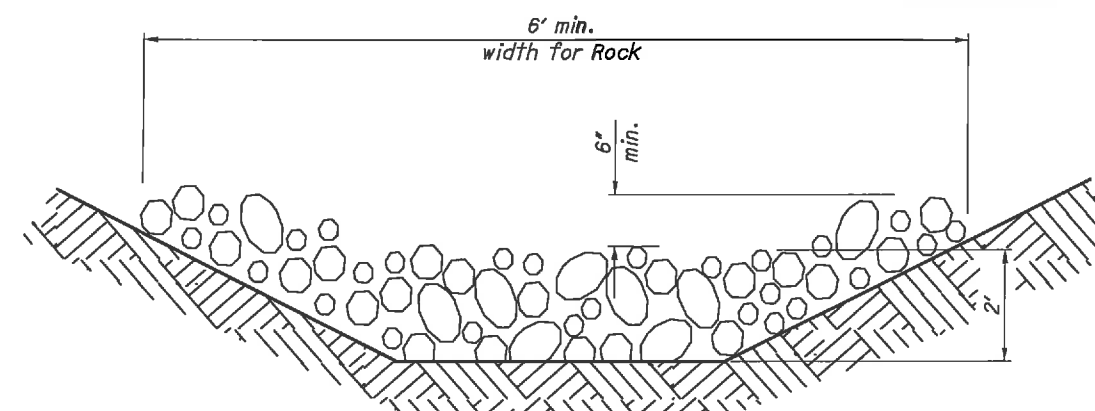
The Department will pay for accepted quantities at the prices shown in Appendix F of Supplemental Specification 832 (SS832) for the following items:

- Rock Channel Protection, Type C or D, Without Filter

All items shown on this Standard Construction Drawing that are required for construction that are not specifically identified in SS832 Appendix F are considered incidental.



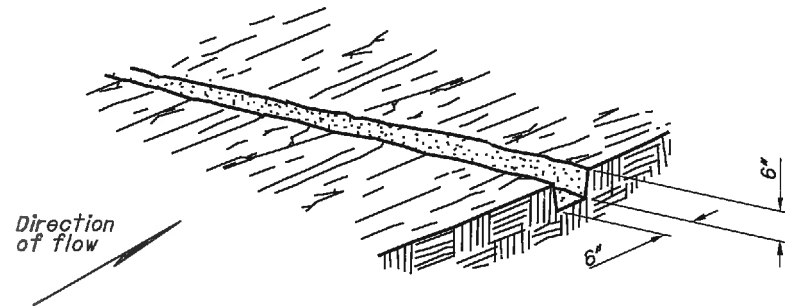
PROFILE VIEW OF FLAT BOTTOM AND V DITCH
SECTION A-A



Minimum dimensions: 2' high x 6' wide x 3' long

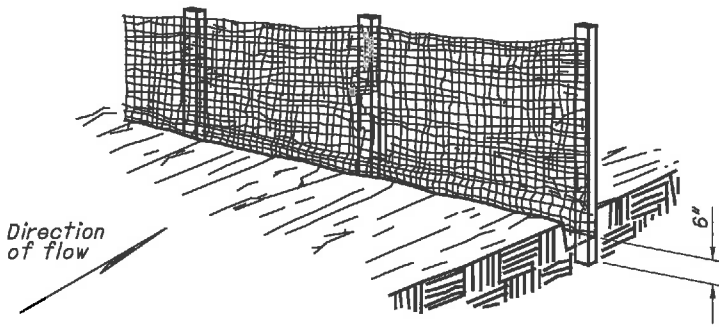
CROSS-SECTIONAL VIEW
ROCK CHECK

PERIMETER GEOTEXTILE FABRIC FENCE



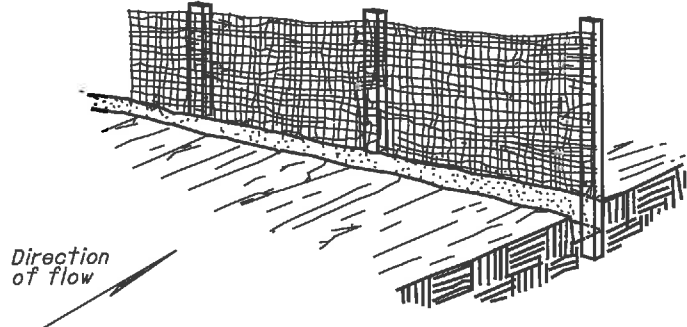
Excavate a 6"x6" trench along the proposed fence line.

STEP 1



Place fabric and support stakes and extend fabric into the trench.

STEP 2



Backfill and compact the excavated soil.

STEP 3

NOTES

MATERIALS:
Furnish 30" wide geotextile fabric with sound wood supports with maximum on-center spacing of 10'. Use geotextile fabric conforming to 712.09, Type C.

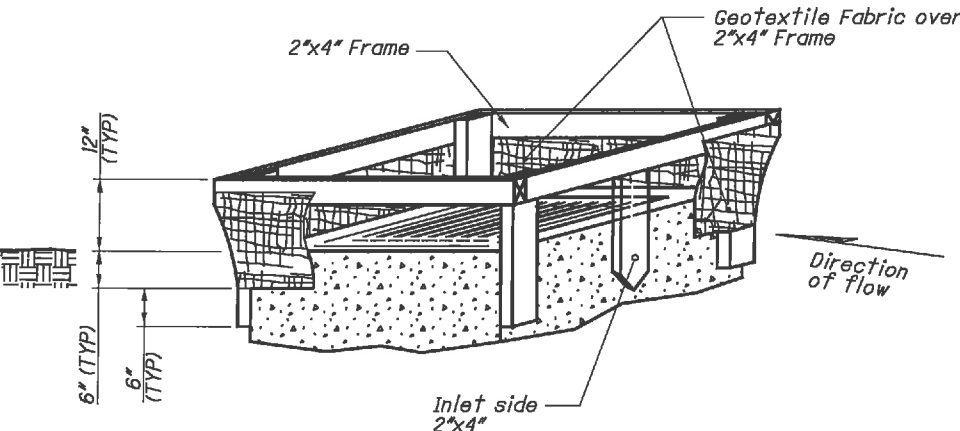
CONSTRUCTION:
Trench the geotextile fabric fence as detailed. The contractor may elect to trench the fence detailed on steps 1 through 3 in one plowing operation.

PAYMENT:
The Department will pay for accepted quantities at the prices shown in Appendix F of Supplemental Specification 832 (SS832) for the following items:

- Perimeter Geotextile Fabric Fence

All items shown on this Standard Construction Drawing that are required for construction that are not specifically identified in SS832 Appendix F are considered incidental.

INLET PROTECTION



INLET PROTECTION

NOTES

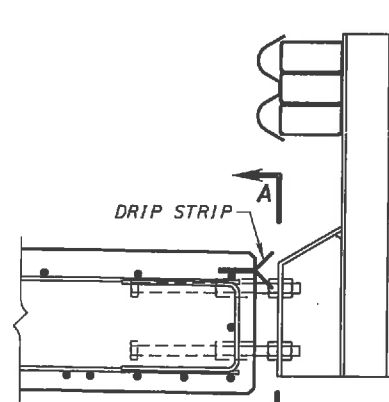
MATERIALS:
Furnish inlet protection consisting of 18" wide geotextile fabric fence with a securely nailed 2"x4" wood frame with a vertically driven 2"x4" on the inlet, or flow, side of the structure. Use geotextile fabric conforming to 712.09, Type C.

CONSTRUCTION:
Construct an 18" wide geotextile fabric fence supported around a storm drain inlet or catch basin with a securely nailed 2"x4" wood frame. Excavate a 6" trench around the inlet, and drive support posts 6" below the excavated trench bottom. Stretch the fabric around the frame. Secure it tightly, ensuring that 6" of fabric is in the trench. Overlap the fabric on one side of the inlet so that the fabric ends are not attached to the same post. Backfill and compact the excavated soil tightly onto the fabric. Place a vertical 2"x4" in the center of the inlet so that the top is at the top of the fence and the bottom is at least 6" below the bottom of the ditch.

PAYMENT:
The Department will pay for accepted quantities at the prices shown in Appendix F of Supplemental Specification 832 (SS832) for the following items:

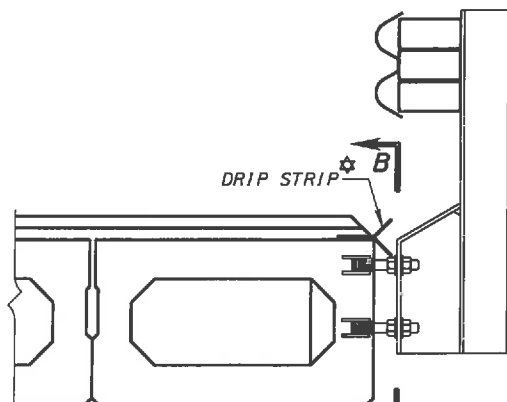
- Inlet Protection

All items shown on this Standard Construction Drawing that are required for construction that are not specifically identified in SS832 Appendix F are considered incidental.



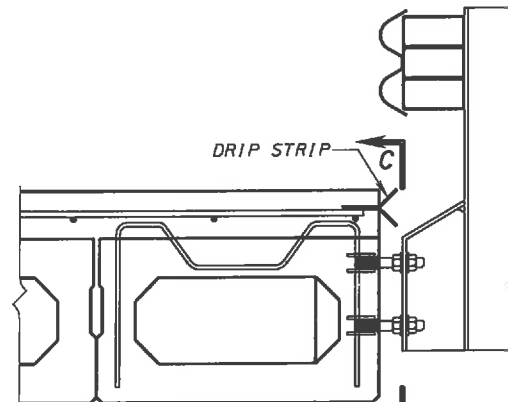
CONCRETE SLAB
WITH DBR-2-73 RAILING

(DECK ON CONCRETE OR STEEL BEAM SIMILAR)



NONCOMPOSITE BOX BEAM
WITH DBR-2-73 RAILING

(DECK ON CONCRETE OR STEEL BEAM SIMILAR)



COMPOSITE BOX BEAM
WITH DBR-2-73 RAILING

(DECK ON CONCRETE OR STEEL BEAM SIMILAR)

DRIP STRIP NOTES

INSTALL LOWER STAINLESS STEEL DRIP STRIP, AS DETAILED, ALONG THE FULL LENGTH OF EACH SIDE OF THE BRIDGE. IF SPLICES ARE REQUIRED IN THE LOWER DRIP STRIP, TIGHTLY BUTT THE INDIVIDUAL PIECES TOGETHER. DO NOT LAP. INSTALL A 1'-6" LONG UPPER DRIP STRIP AT EACH RAILING POST. BEND UP STRIPS AT 90° AGAINST THE INSIDE FACE OF THE FORMS BEFORE CONCRETE IS PLACED. AFTER THE FORMS ARE REMOVED, BEND THE DRIP STRIPS INTO THE FINAL POSITION OF 45° AS SHOWN HEREIN.

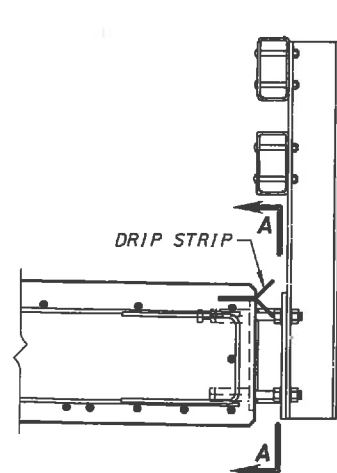
STAINLESS STEEL SHALL BE A MINIMUM OF 22 GAGE ASTM A167, TYPE 304, MILL FINISH.

USE CARE WHEN STRIPPING FORMWORK SO AS NOT TO DAMAGE OR WRINKLE THE STAINLESS STEEL DRIP STRIP. TO FURTHER ENSURE THAT WRINKLING OF THE STRIPS DOES NOT OCCUR, USE AN ADEQUATE LENGTH BACKUP BAR DURING THE BENDING OUT OPERATION.

THE DEPARTMENT WILL MEASURE THE DRIP STRIP BY THE FOOT AND WILL INCLUDE THE TOTAL LENGTH OF BOTH THE UPPER AND LOWER DRIP STRIPS.

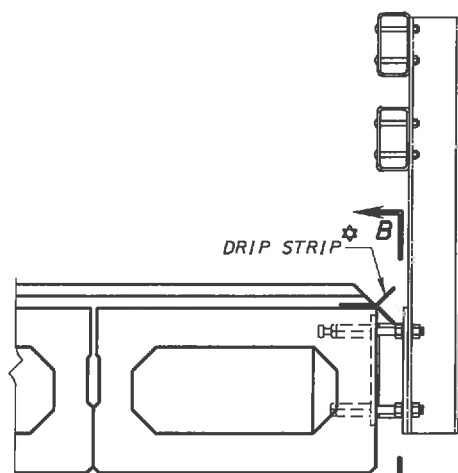
THE DEPARTMENT WILL PAY FOR ACCEPTED QUANTITIES AT THE CONTRACT PRICE FOR ITEM SPECIAL, STEEL DRIP STRIP.

★ PRIOR TO PLACING THE ASPHALT OVERLAY, INSTALL THE BENT DRIP STRIPS ALONG THE EDGE OF THE PRESTRESSED BOX BEAM AS SHOWN. FASTEN THE DRIP STRIPS WITH (1 1/4" LENGTH, 3/32" SHANK DIAMETER) BUTTON HEAD SPIKES WITH DEFORMED SHANKS OR EXPANSION ANCHORS AT 1'-6" C/C MAX. ALL INSTALLATION DEVICES SHALL BE GALVANIZED OR STAINLESS STEEL. OTHER SIMILAR DEVICES SHALL NOT BE USED UNLESS APPROVED BY THE ENGINEER.



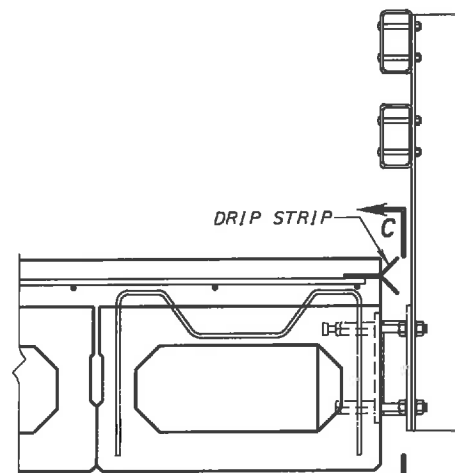
CONCRETE SLAB
WITH TST-1-99 RAILING

(DECK ON CONCRETE OR STEEL BEAM SIMILAR)



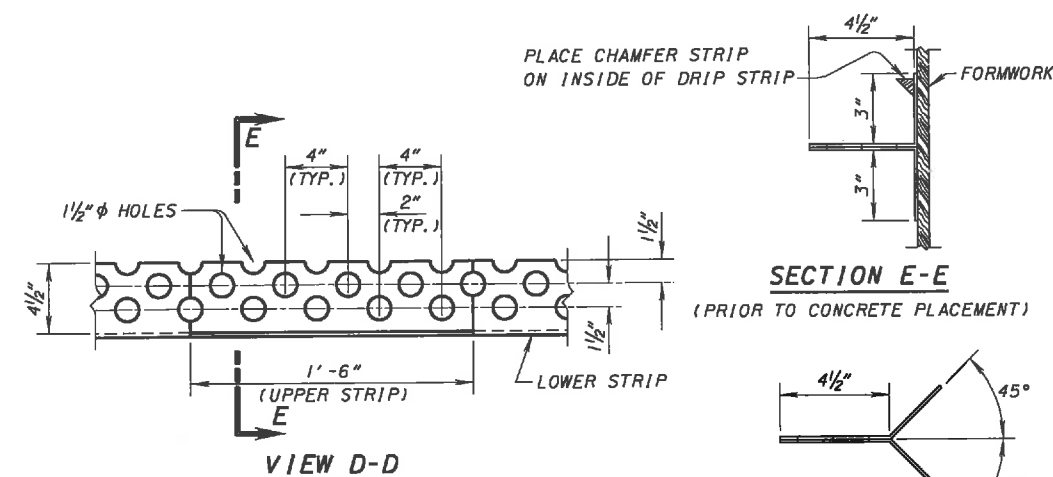
COMPOSITE BOX BEAM
WITH TST-1-99 RAILING

(DECK ON CONCRETE OR STEEL BEAM SIMILAR)

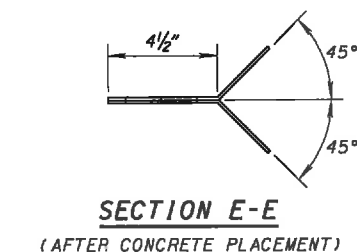


COMPOSITE BOX BEAM
WITH TST-1-99 RAILING

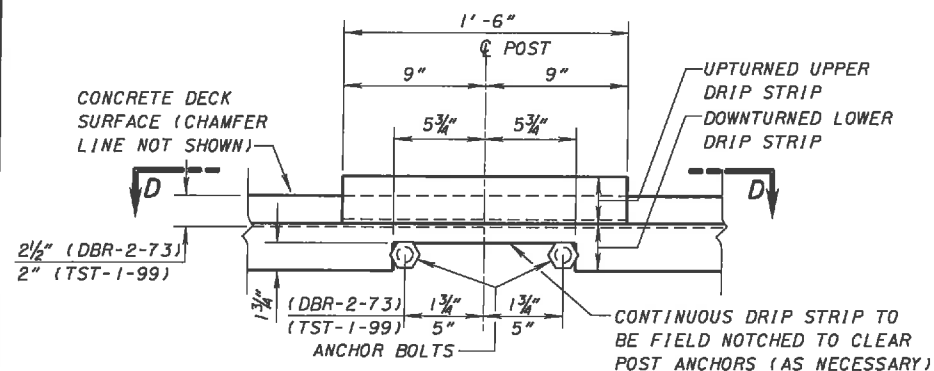
(DECK ON CONCRETE OR STEEL BEAM SIMILAR)



SECTION E-E
(PRIOR TO CONCRETE PLACEMENT)

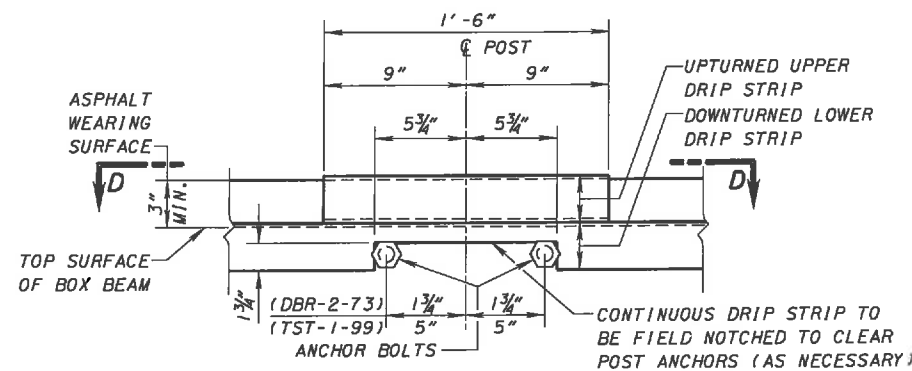


SECTION E-E
(AFTER CONCRETE PLACEMENT)



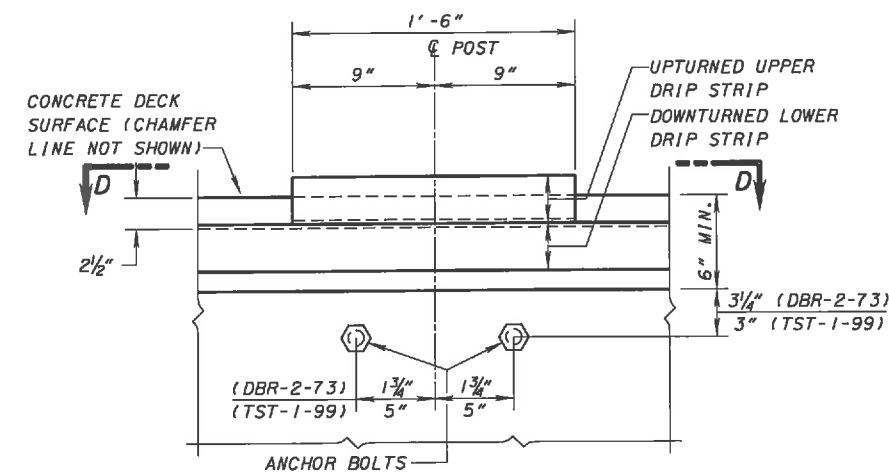
VIEW A-A

(STRIP SHOWN PRIOR TO CONCRETE PLACEMENT)



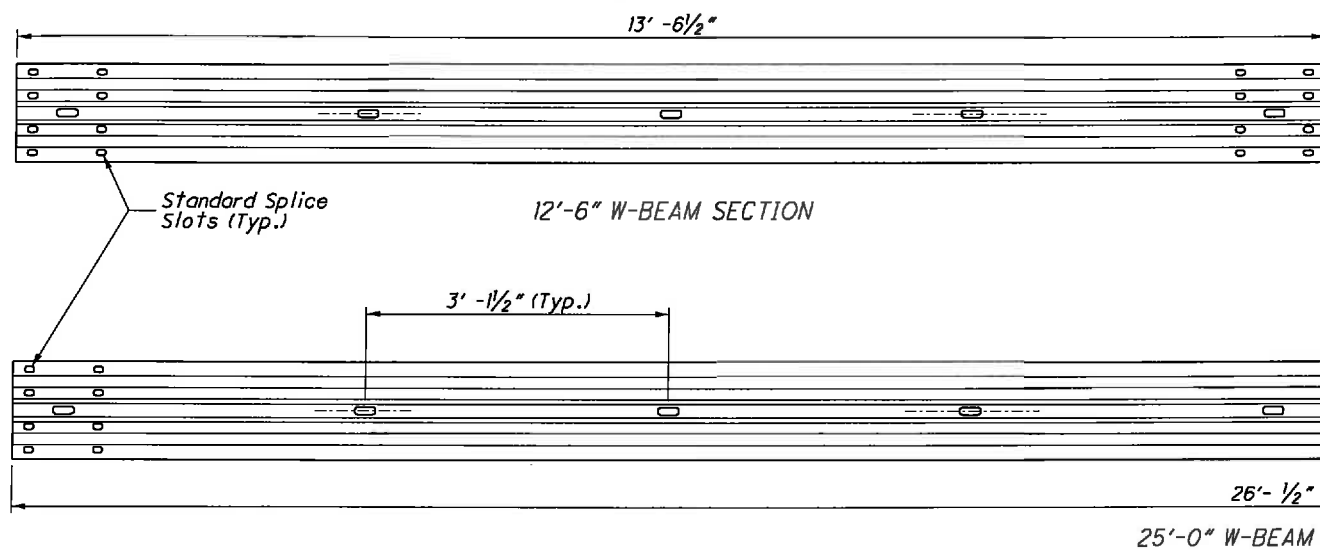
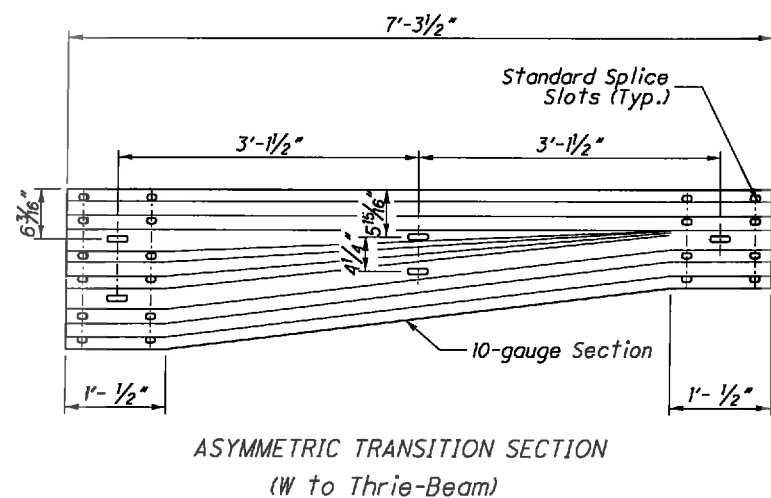
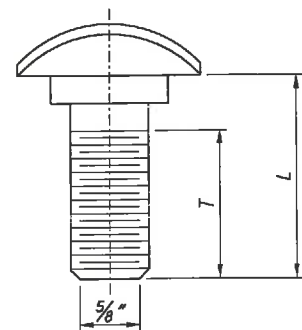
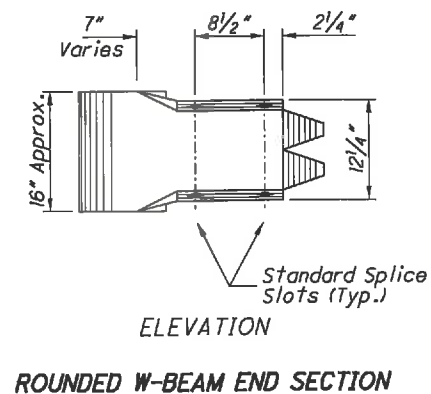
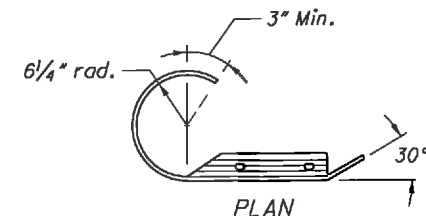
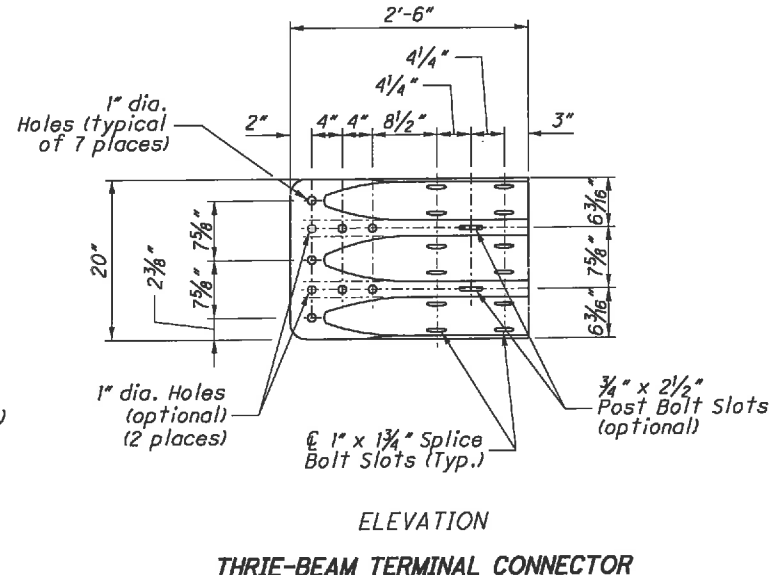
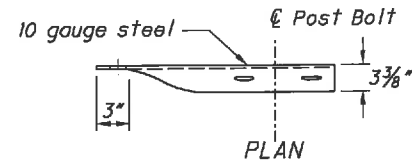
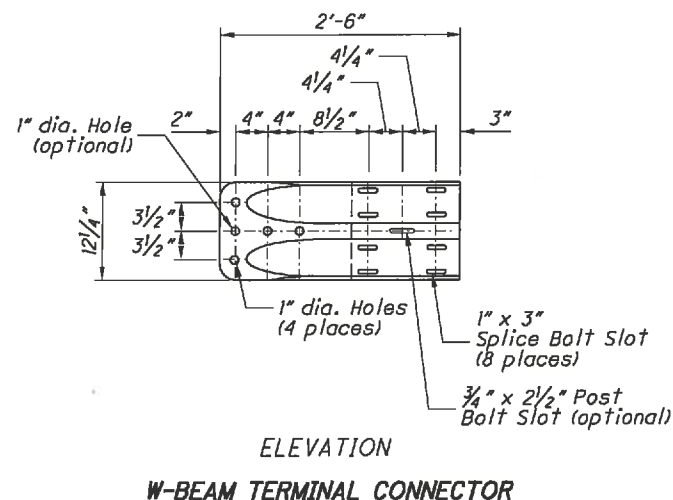
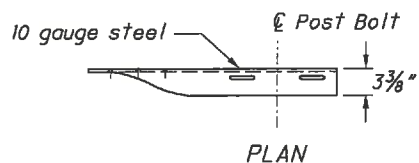
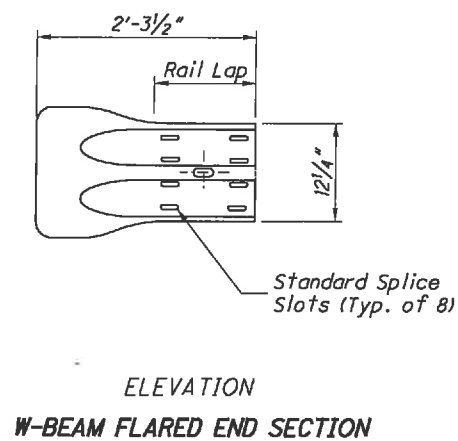
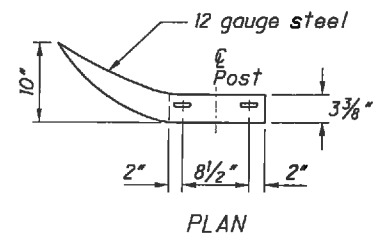
VIEW B-B

(STRIP SHOWN PRIOR TO CONCRETE PLACEMENT)



VIEW C-C

(STRIP SHOWN PRIOR TO CONCRETE PLACEMENT)



NOTES

GENERAL: Components shown on this drawing are used in a variety of guardrail systems. See individual guardrail drawing for specific applications.

See CMS 606 for guardrail specifications not covered on these drawings.

Refer to AASHTO M 180-12 for dimensional details of W-Beam and Thrie-Beam rail elements, related buffer and end sections, beam splices, post and splice bolts, nuts, and Type 1 W-Beam to Thrie-Beam Transition sections. **Beam washers are not to be used.** Bolts grade shall be ASTM A307.

RAIL ELEMENTS: Unless otherwise specified, W-Beam Rail is 12 gauge steel with an effective length of 12'-6" or 25'-0", with 3/4"x1 1/4" splice bolt slots, and 3/4"x2 1/2" post bolt slots on 3'-1 1/2" centers regardless of post spacing. Field punch or drill bolt holes or slots for irregularly spaced posts as specified in CMS 606.04.

Substituting one 10 gauge steel beam element where two nested 12 gauge steel beams are specified is permitted (both W-beam and Thrie-beam).

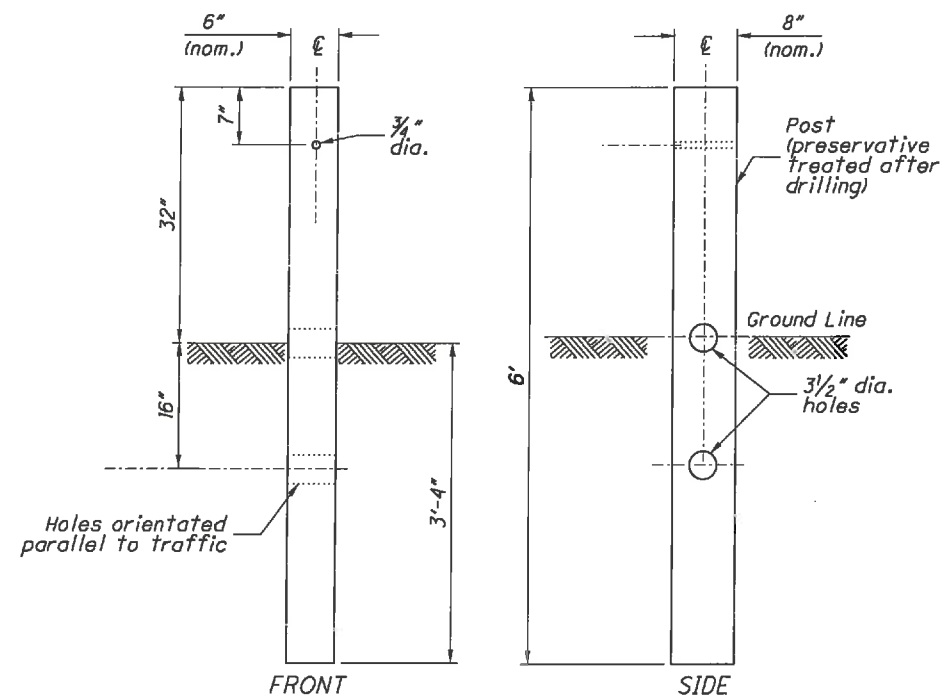
RAIL SPLICES: Lap splices between two rail elements or between a rail and terminal connector in the direction of traffic. Lap the flared end sections in the direction of traffic.

GUARDRAIL BOLT (For Post and Splice Bolts)		
L	T min.	Bolt Use
22" (Standard Rail)	4"	Type MGS: WP/WB, PB
34" (Barrier Rail)		Type MGS: SP/WB, PB
14"	4"	Type MGS: SP/WB, PB
1 1/4"	1 1/8"	Splice Bolt

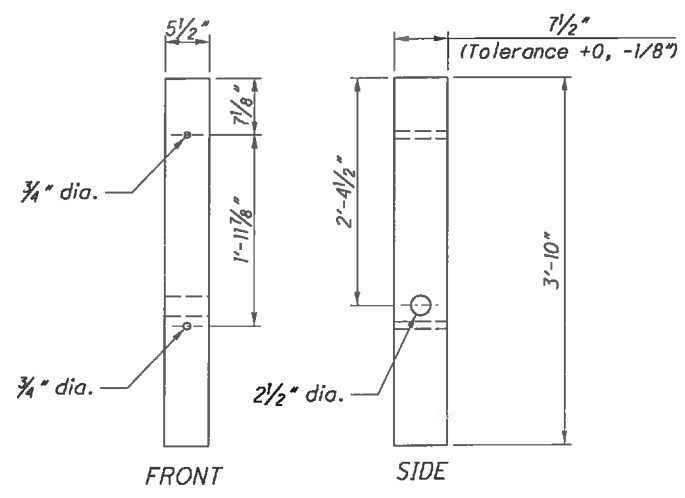
WP = Wood Post
SP = Steel Post
WB = Wood Blockout
PB = Plastic Blockout

Longer Bolt may be needed for round Wood Post larger than 8" dia.

THIS DRAWING REPLACES MGS-1.1 DATED 1-18-2013

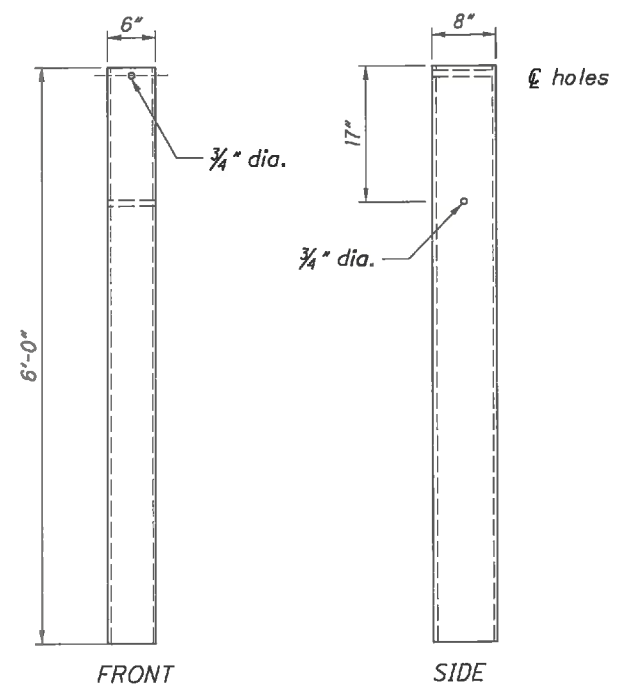


TYPE 1 BREAKAWAY CRT POST

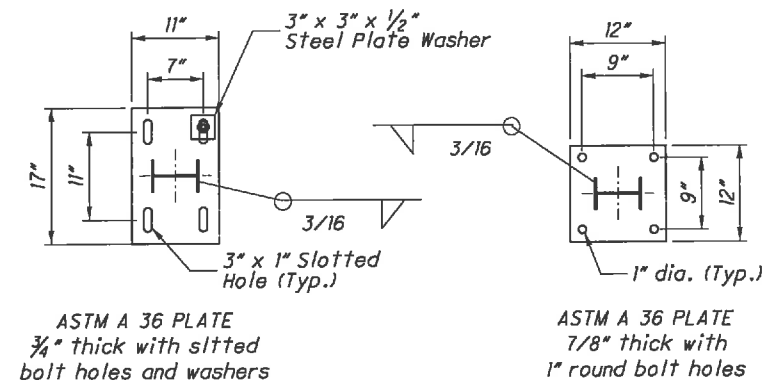


TYPE 2 BREAKAWAY BCT TIMBER POST

STEEL BEAM POSTS				
Size	Beam depth	Flange width	Flange thickness	Web thickness
Rolled W6x8.5	5.8"	3.94"	0.193"	0.170"
Rolled W6x9	5.9"	3.94"	0.215"	0.170"
Welded 6x8.5	6.0"	3.94"	0.193"	0.170"
Welded 6x9	6.0"	3.94"	0.215"	0.170"



STEEL GROUND FOUNDATION TUBE



NOTES

GUARDRAIL HEIGHT: For initial installation, construct the guardrail within $\pm 1"$ of the standard 31" height to the top of W-Beam rail. When subsequent projects, such as resurfacings, affect the height of existing guardrail, adjustment is not required if the finished height is within $\pm 3"$ of the standard height.

POSTS: The Standard Post Length is 6'-0" (+3", -0" tolerance). Wood Posts are permitted instead of Standard Steel Posts per CMS 710.11.

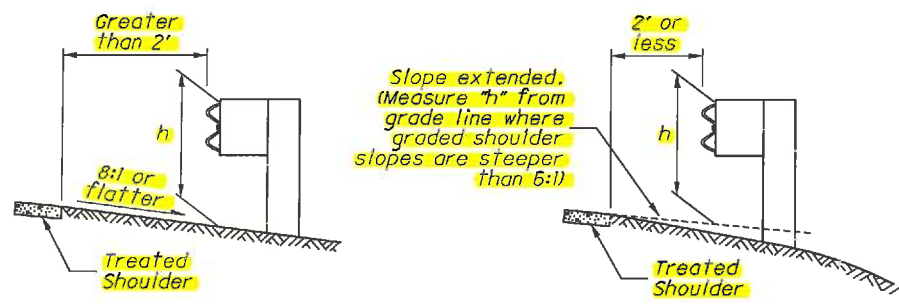
POST EMBEDMENT DEPTH: Standard embedment depth is 3'-4" minimum. Do not drive posts located over a culvert with less than 4'-3" of cover; instead set in drilled or dug holes. Where site constraints prohibit the post from being placed at least one foot in front of the slope break point, use longer posts as shown in the Guardrail Post Length and Position Detail. The face of the rail may not be beyond the slope break point.

SPECIAL POST MOUNTINGS: Install posts located over a drainage inlet or structure with a cover of less than 3'-4" as shown in the FOOTING ANCHOR Detail.

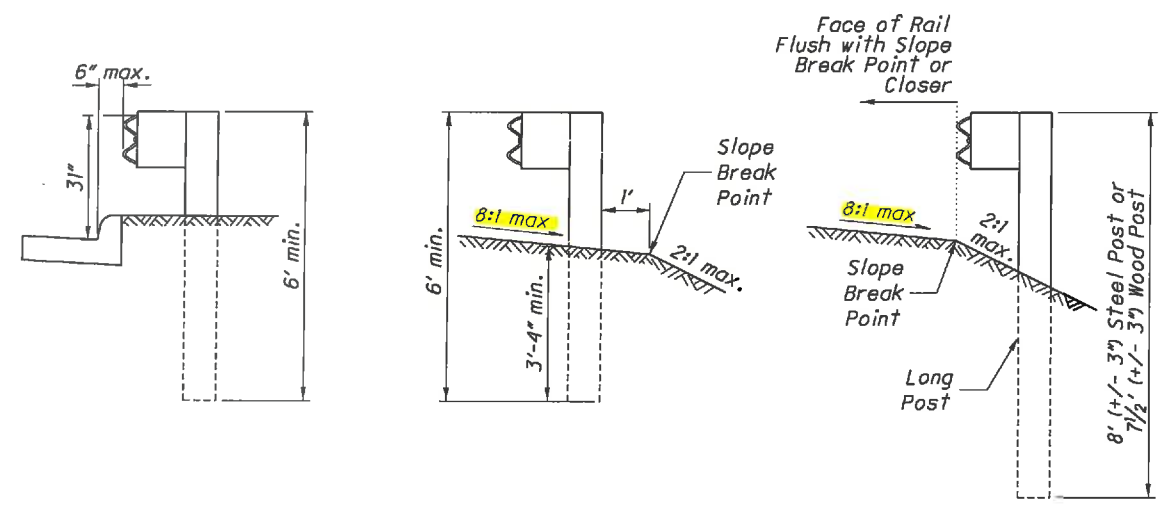
ANCHORS: Holes shall comply with CMS 510. Use non-shrink, nonmetallic grout per CMS 705.20.

PROTECTIVE COATING: In lieu of the complying with CMS 710.06, coat expansion shields, anchors and concrete insert anchor assemblies embedded in concrete in accordance with ASTM A 153 or be of stainless steel. Any bolts screwed into these devices shall meet CMS 710.06.

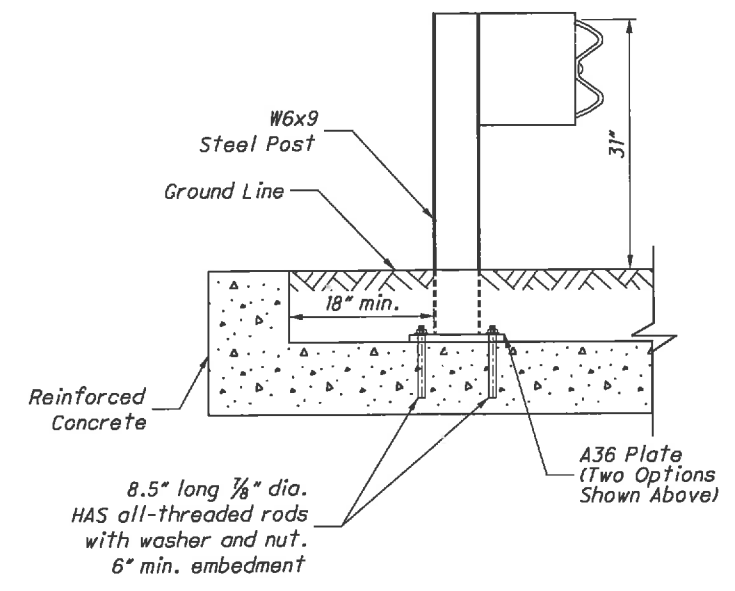
PAYMENT: Payment for standard guardrail is measured in feet as Item 606 - Guardrail, Type MGS. Runs with longer posts should be paid as Item 606 - Guardrail, Type MGS With Long Posts, also measured in feet. All costs associated with special post mountings are included in the unit price bid of Item 606 Guardrail of the type specified in the plans.



MEASURING GUARDRAIL HEIGHT

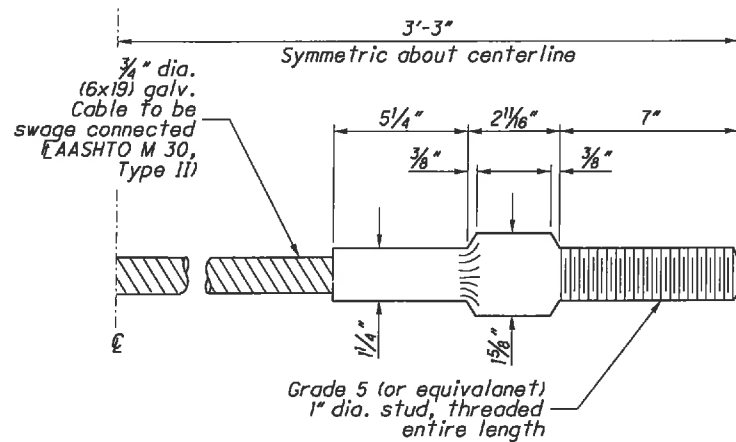


GUARDRAIL POST LENGTH AND POSITION

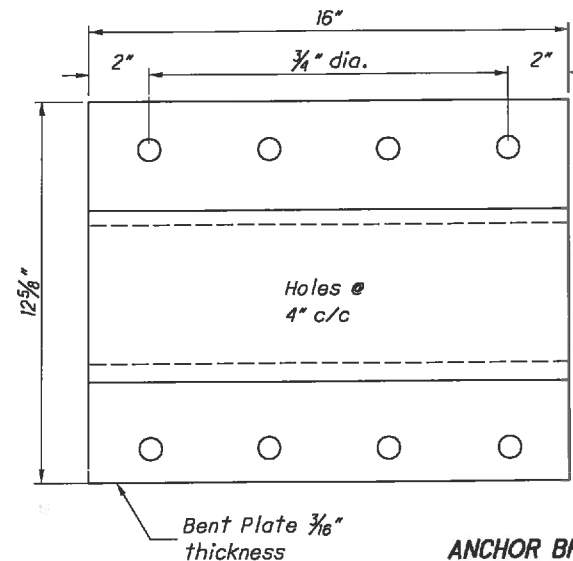


FOOTING ANCHOR DETAIL

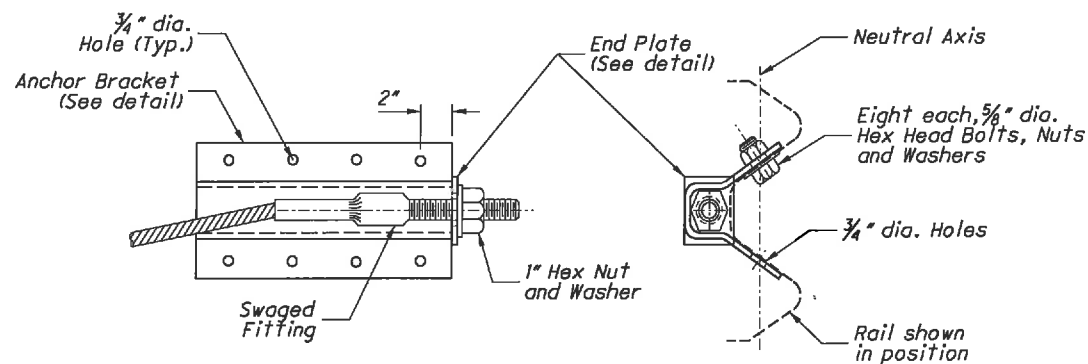
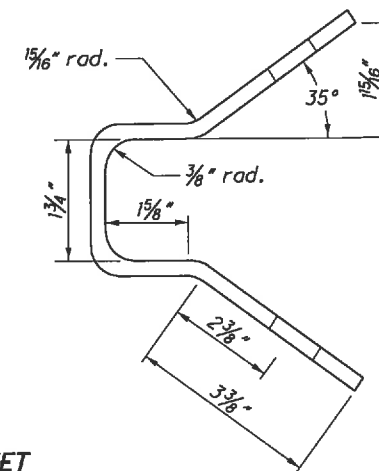
THIS DRAWING REPLACES MGS-1.1 DATED 1-18-2013



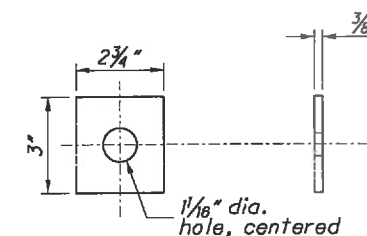
STANDARD SWAGED FITTING AND STUD
CABLE ANCHOR



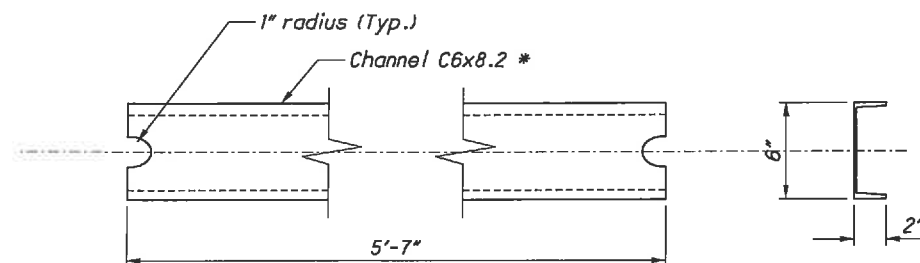
ANCHOR BRACKET



ANCHOR BRACKET ASSEMBLY DETAILS

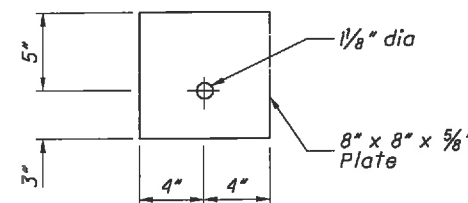


END PLATE

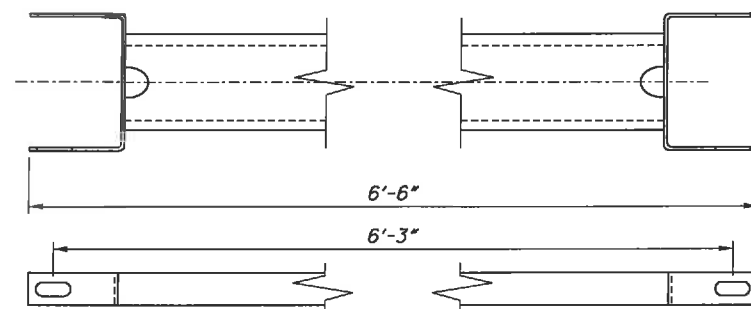


STRUT

* A 6"x3" 10 Gauge Bent Plate Strut may be substituted for the C-Channel

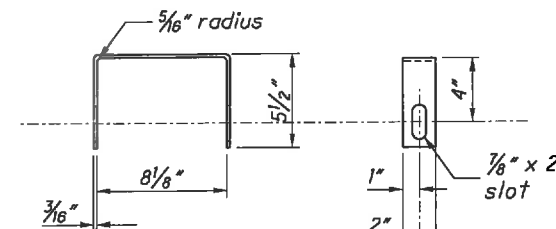


BEARING PLATE



Channel legs shown down. For opposite hand, install Channel legs up.

STRUT AND YOKE ASSEMBLY



YOKE

Two required in Assembly

THIS DRAWING REPLACES MGS-1.1 DATED 1-18-2013

SCD NUMBER

MGS-1.1

STANDARD ROADWAY CONSTRUCTION DRAWING
MIDWEST GUARDRAIL SYSTEM
GUARDRAIL DETAILS
(Rail Components)

OFFICE OF
ROADWAY
ENGINEERING

STATUS:
ENGINEER
M. Ruppe

STATE OF OHIO DEPARTMENT OF
TRANSPORTATION ADMINISTRATOR

Michael Blaine

REVISION DATE

7-19-2013

NOTES

RAIL: Use W-Beam rail meeting AASHTO M 180-12 Type II Class A, as specified in CMS 606. Either 13'-6 1/2" long (12'-6" between splices) or 26'-1/2" long (25'-0" between splices) rail sections may be used.

POSTS: Posts may be constructed of wood or steel. Use the same type of post throughout the length of the project unless otherwise specified in the plans or permitted by the Engineer.

Wood post shall be fabricated and pressure-treated for approved species as per CMS 710.12. Bore bolt holes and, if required, trim the tops of posts after the posts are set.

See SCD MGS-1.1 for Standard Steel Posts.

All posts are 6'-0" long (+3", -0 tolerance) unless specified otherwise in the Contract Document. Posts may be set in drilled holes or may be driven to grade.

BLOCKOUTS: Blockout dimensions are dependent on post used. Wood Blockouts are to be pressure treated as specified in CMS 710.14. Bore bolt holes. Approved Alternate blockouts may be used in lieu of the wood blockouts shown. The approved list is maintained by the Office of Roadway Engineering.

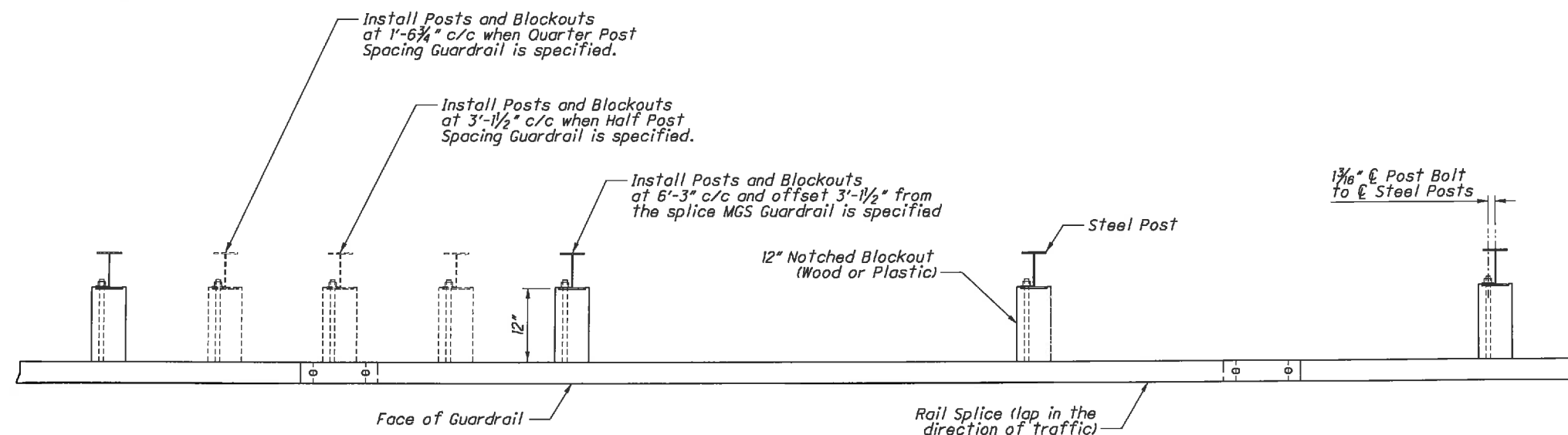
When terminating double-sided barrier guardrail with an impact attenuator, use reduced 8" deep blockouts on the last * posts on the barrier design to accommodate the narrower widths of the attenuators.

WASHERS: Install appropriate sized standard galvanized steel washers on the nut side of bolts installed on wood posts. Beam washers are not to be used.

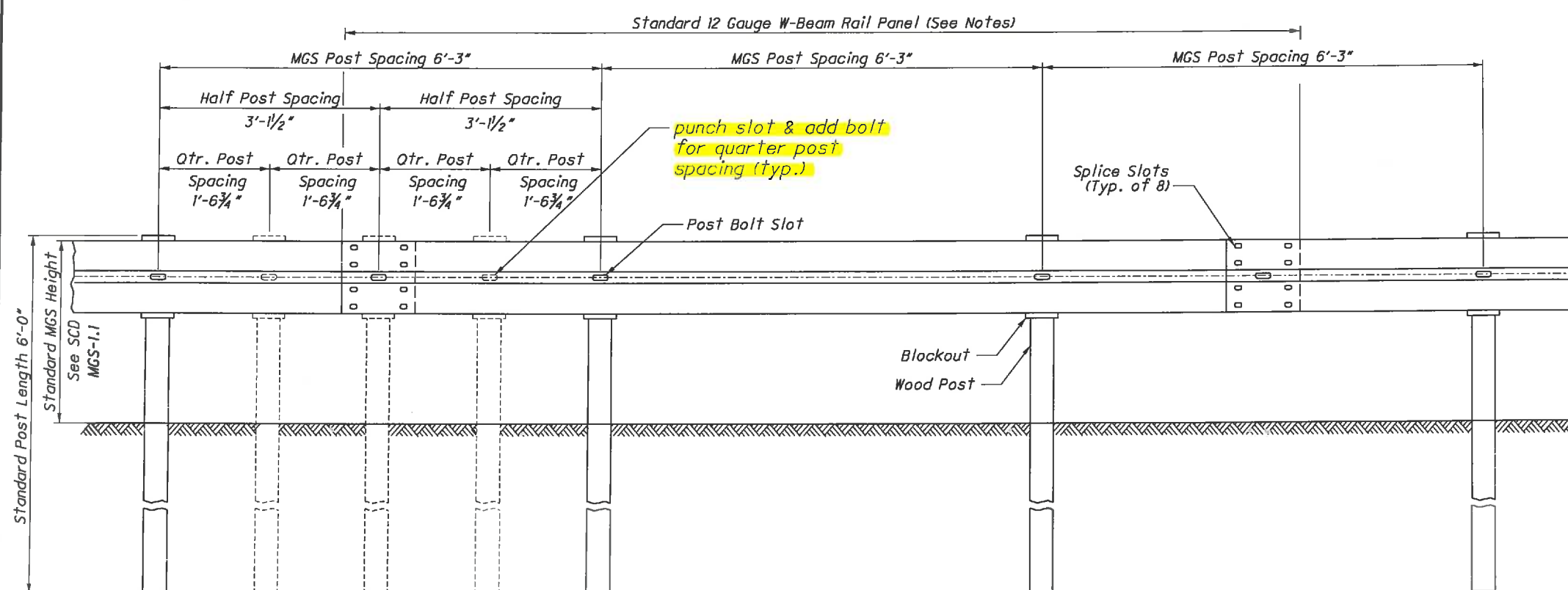
DELINEATION: For Barrier Reflectors see CMS 626.

MISCELLANEOUS: For other guardrail details, see SCD MGS-1.1.

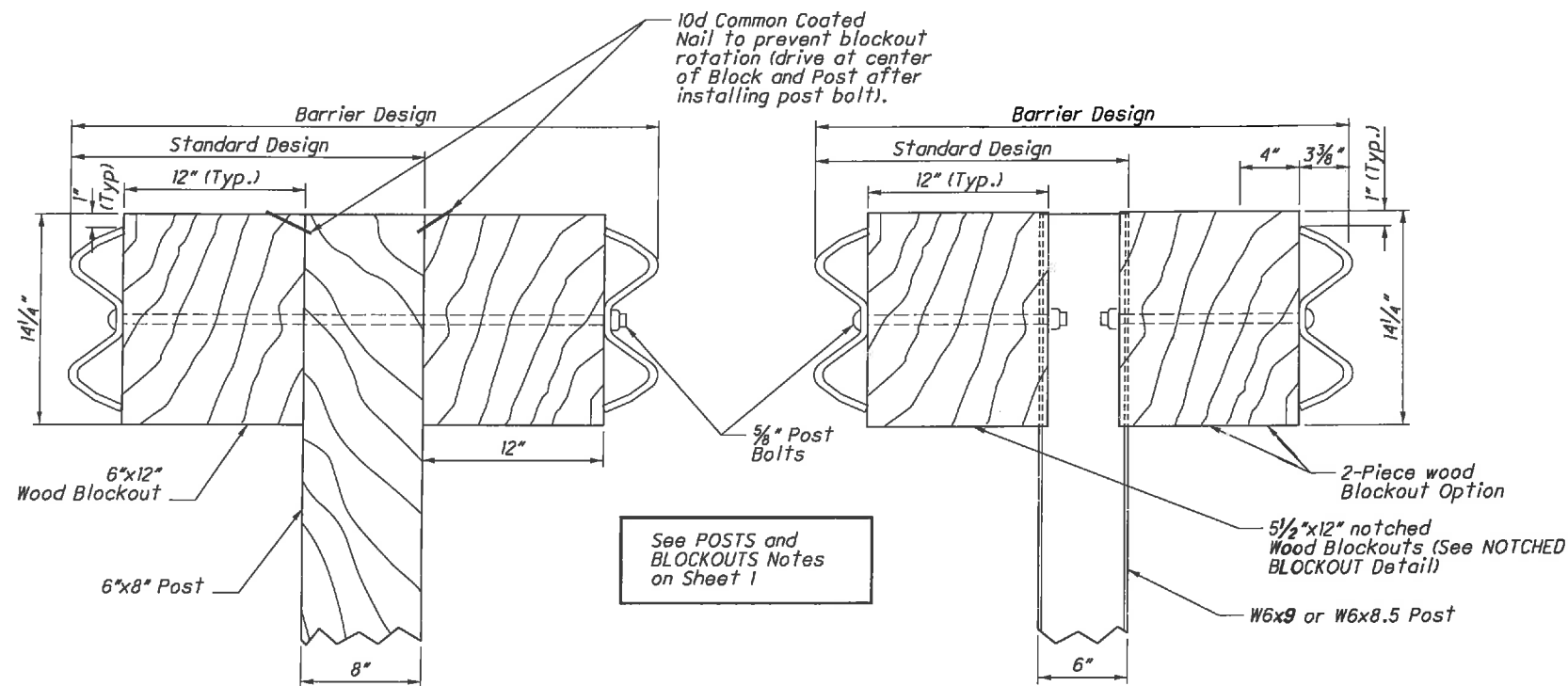
PAYMENT: Guardrail is paid in feet per
ITEM 606 - Guardrail, Type MGS.
 Half or Quarter Post Spacing Guardrail per
ITEM 606 - Guardrail, Type MGS Half Post Spacing
ITEM 606 - Guardrail, Type MGS Quarter Post Spacing



PLAN VIEW
 (Steel Posts shown)

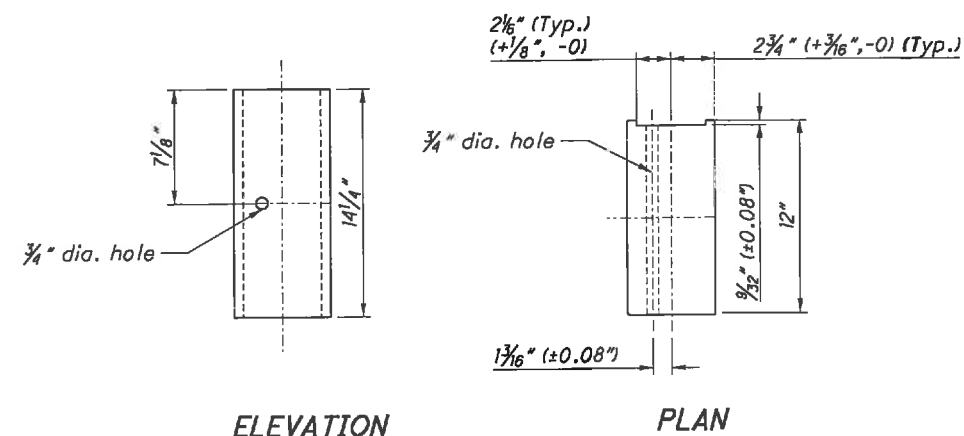


ELEVATION
 (Wood Posts shown)

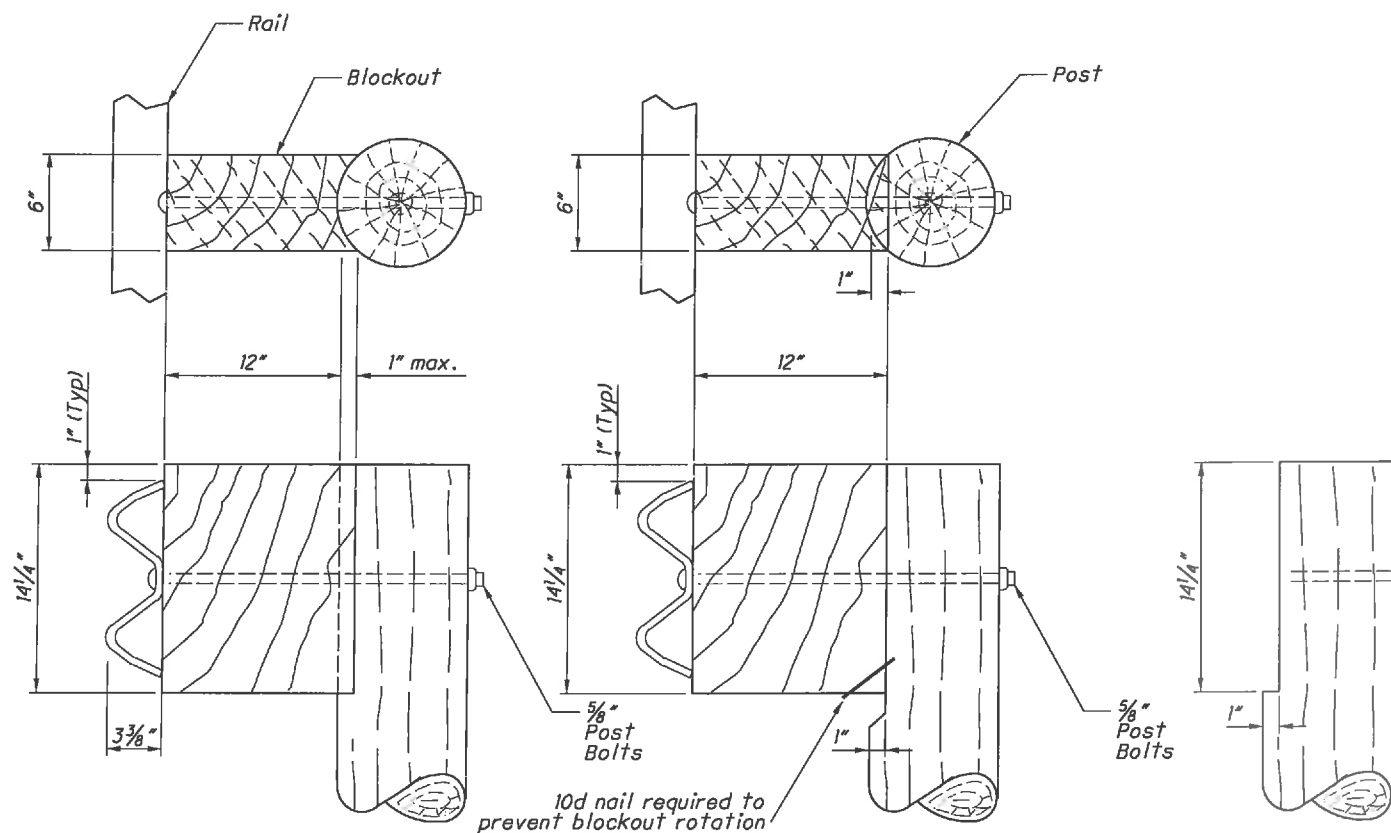


SQUARE WOOD POST

STEEL POST
See POSTS Note, Sheet 1



NOTCHED BLOCKOUTS FOR STEEL POSTS
See BLOCKOUTS Note on Sheet 1

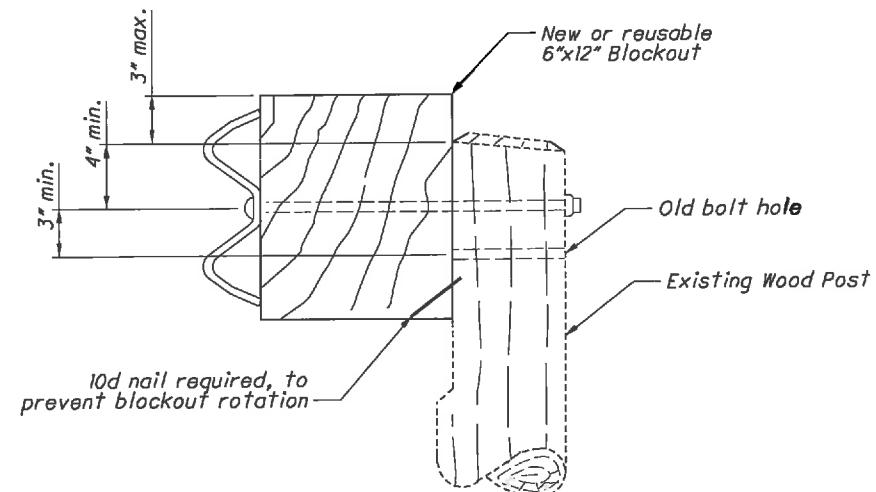
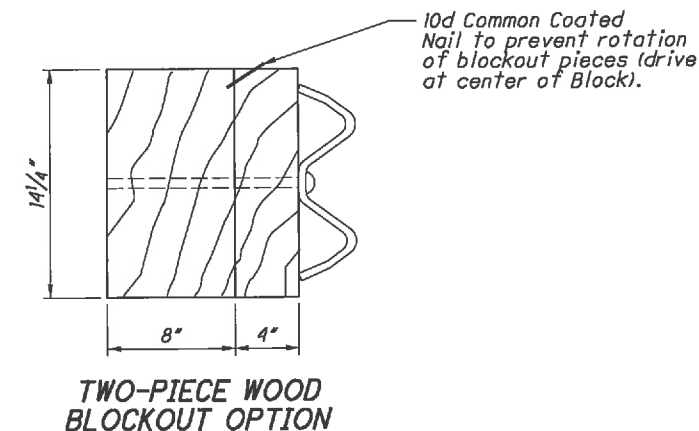


Method 1 Routed Blockout

Method 2 Notched Post

Alternate methods of placing the Blockouts on round Posts may be submitted for consideration and approved by the Engineer.

ROUND WOOD POSTS
Single Sided runs only (Standard Design)



RAISING EXISTING GUARDRAIL HEIGHT

THIS DRAWING REPLACES MGS-2.1 DATED 1-18-2013

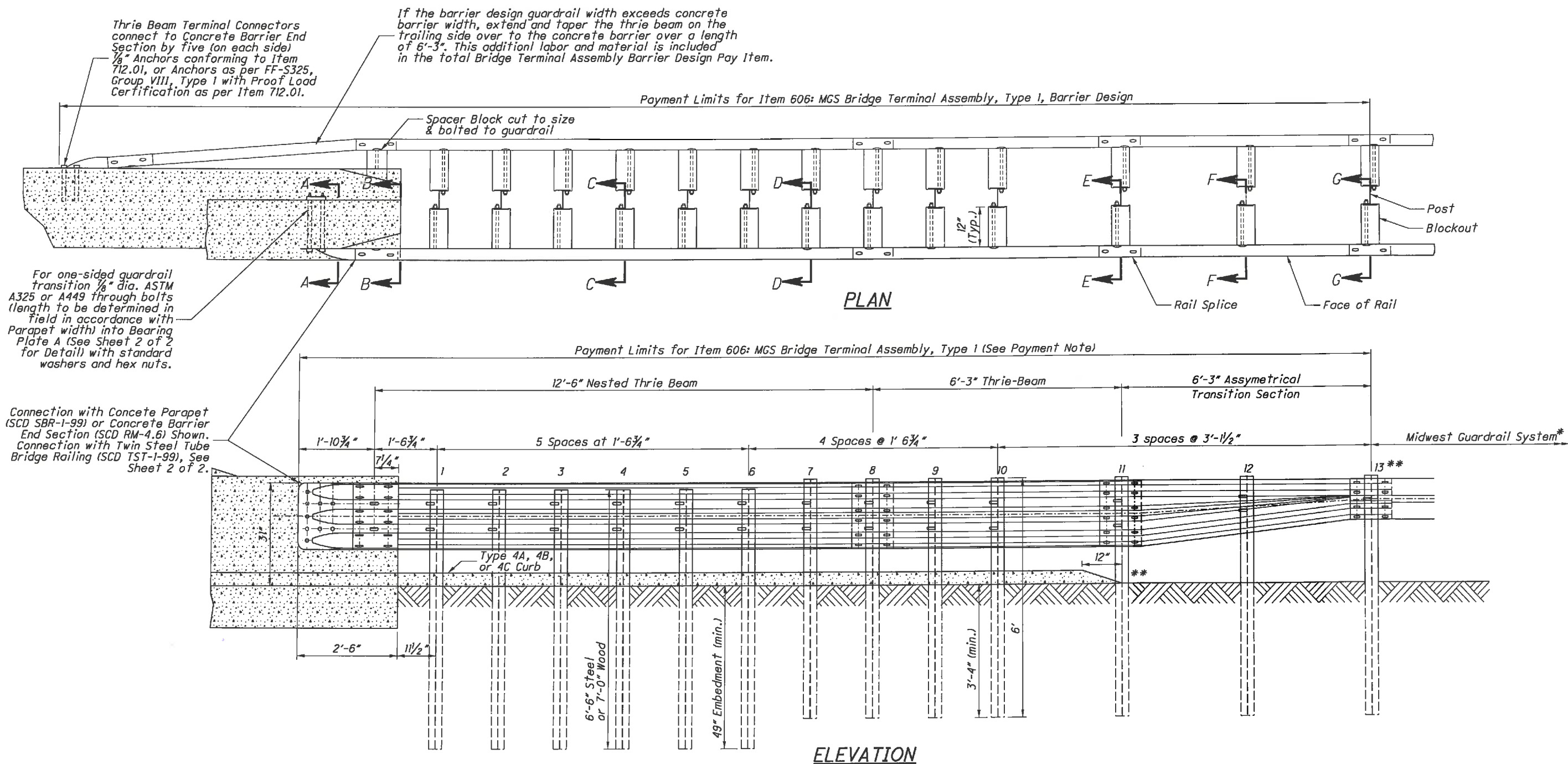
STANDARD ROADWAY CONSTRUCTION DRAWING
MIDWEST GUARDRAIL SYSTEM
STANDARD TYPE MGS
Regular, Half, & Quarter Post Spacing

MGS-2.1

STDS. ENGINEER
M. Ruppe

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR
Michael Blaine

REVISION DATE
7-19-2013



NOTES

GENERAL: For additional rail details, see **SCD MGS-1.1**. For barrier guardrail details see **SCD MGS-2.1**. See Sheet 2 for Sections (single sided BTA shown).

APPLICATION: Use Type 1 MGS Bridge Terminal Assembly to connect guardrail runs to bridges having deflector Parapet Type Bridge Railing (see Structural Engineering's **SCD BR-1**) and for runs to the approach ends of Concrete Barrier (see **SCD RM-4.6**).

This BTA should also be used to connect guardrail runs to bridges with Twin Steel Tube Railing (see Structural Engineering's **SCD TST-1-99**). Connection details for the TST are shown on Page 2.

THRIE BEAM: An 18'-9" Section of Thrie beam may be substituted for one of the 12'-6" panels and the 6'-3" section as shown.

When attaching this BTA to preexisting walls/parapets, a longer thrie beam panel (approx. 1'-6" additional length) is permitted to reach the available bolt hole locations.

THRIE BEAM TRANSITION: Asymmetrical W-Beam to Thrie Beam transition panel shall be 10 gauge.

POSTS: Use standard steel or 6"x8"x72" wood posts per **SCD MGS-2.1** for Posts No. 7-13. Posts may be set in drilled holes or driven to grade. Posts No. 1-6 are 6'-6" W6x9 steel or 6"x8"x84" wood.

Use the same post material throughout the length of the transition unless otherwise specified in the plans or permitted by the Engineer (steel posts shown in this drawing).

Wood posts shall be fabricated and pressure-treated for approved species as per CMS 710.12. Bore bolt holes and, if required, trim the tops of posts after the posts are set.

BLOCKOUTS: Use 6"x12"x19" (or 6"x12"x22") wood blockouts at Posts No. 1-12. The standard MGS 6"x12"x14" blockout is used at Post 13. Approved Alternate Blockouts can be found on the Office of Roadway Engineering's website. Steel Blockouts are not permitted.

FLARED GUARDRAIL: The MGS guardrail should be tangential within 25 ft. of the BTA.

CURB: Type 4A, 4B, or 4C Curb per **SCD BP-5.1** is required under the thrie-beam portion of this transition when connecting to concrete barrier or parapet, but shall not extend past Post No. 11. Curb is NOT required when connecting to TST Bridge Rail.

**** Where curb must extend upstream of Post No. 11 for drainage purposes, an extra 12'-6" panel of 12 gauge w-beam must be nested prior to the transition (upstream of Post No. 13). This added component shall be included as incidental to the cost of the BTA.**

PAYMENT: Item 606 - MGS Bridge Terminal Assembly, Type 1, Each or Item 608 - MGS Bridge Terminal Assembly, Type 1, Barrier Design, Each, includes the cost of all components including additional and different size of posts and blockouts, nested Thrie-Beam, transition and connector sections, Bearing Plate, bolts, washers, nuts, and other hardware.

Curb is paid separately under **Item 609 - Curb, Type 4**, in feet.

* Place the first post of the MGS 3'-1 1/2" past the BTA, then every 6'-3" thereafter to keep posts offset from the rail splices. A minimum of 12'-6" of MGS Guardrail should be placed between the BTA and end anchor.

THIS DRAWING REPLACES MGS-3.1 DATED 7-19-2013

STANDARD ROADWAY CONSTRUCTION DRAWING
MIDWEST GUARDRAIL SYSTEM

MGS BRIDGE TERMINAL ASSEMBLY, TYPE 1

OFFICE OF
ROADWAY
ENGINEERING

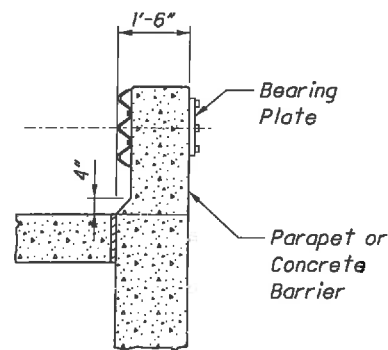
STATE ENGINEER
M. Ruppe

STATE OF OHIO DEPARTMENT OF
TRANSPORTATION ADMINISTRATOR
Michael Blaine

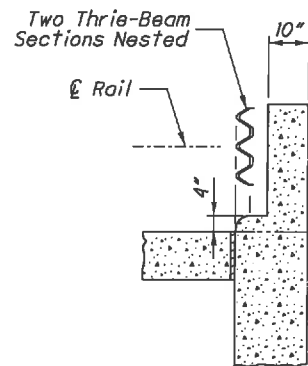
REVISION DATE
7-18-2014

SCD NUMBER
MGS-3.1

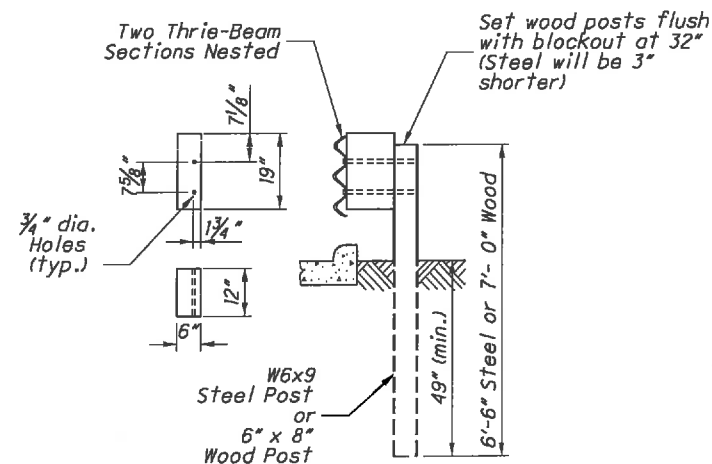
1 / 2



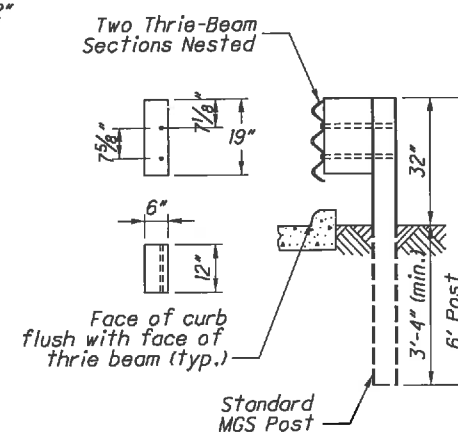
SECTION A-A



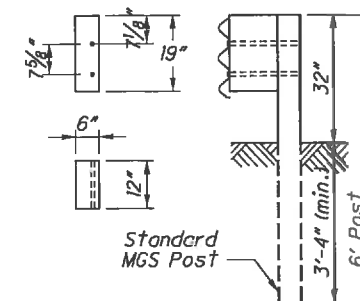
SECTION B-B



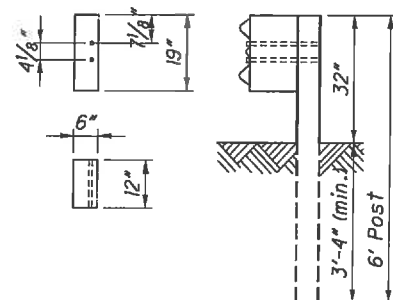
SECTION C-C



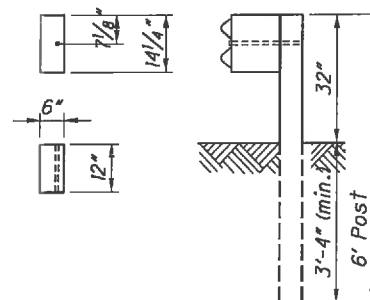
SECTION D-D



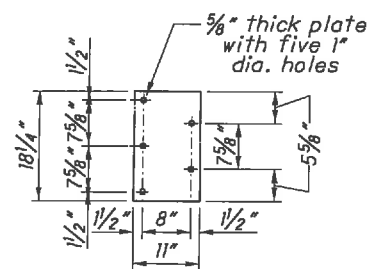
SECTION E-E



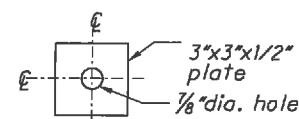
SECTION F-F



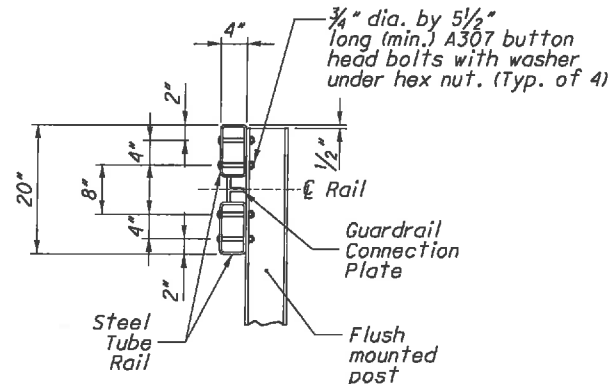
SECTION G-G



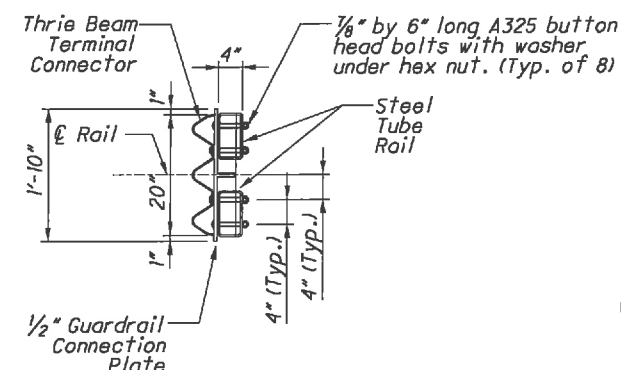
BEARING PLATE A



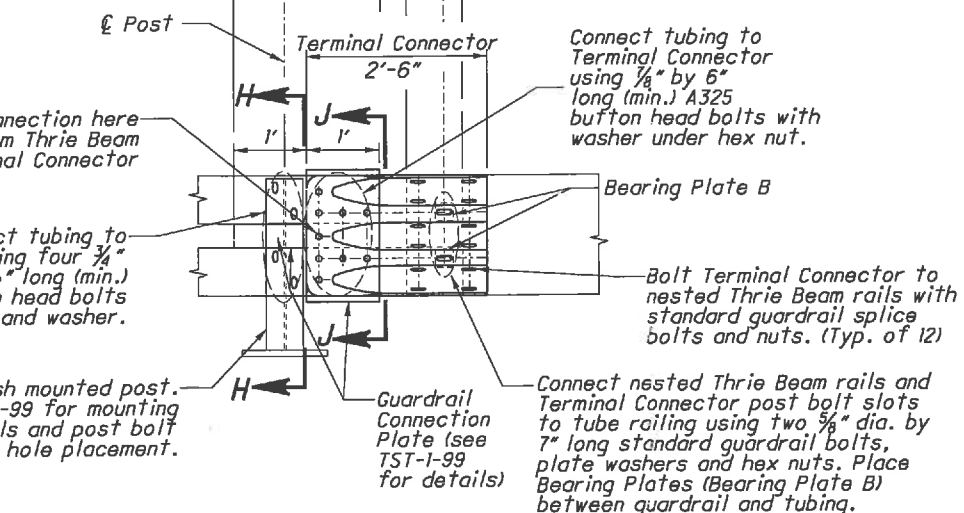
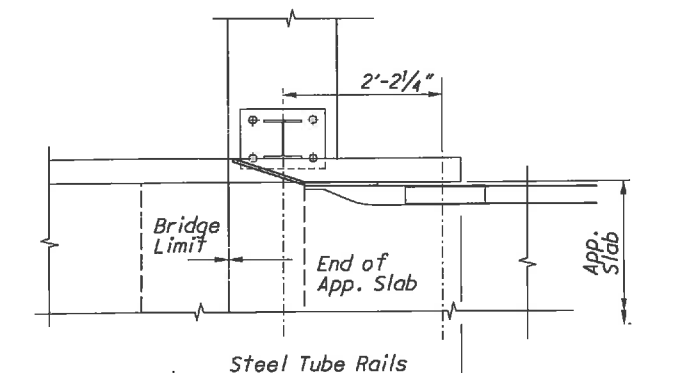
BEARING PLATE B
AASHTO/AGC/ARTBA
Standardized Hardware
Guide part FWRO9



SECTION H-H
Section through Tubing at Post



SECTION J-J
Section through Tubing
at Terminal Connector



CONNECTION DETAILS TO CONNECT
WITH TWIN STEEL TUBE BRIDGE RAILING
(SEE SCD TST-1-99)

THIS DRAWING REPLACES MGS-3.1 DATED 7-19-2013

STANDARD ROADWAY CONSTRUCTION DRAWING
MIDWEST GUARDRAIL SYSTEM

MGS BRIDGE TERMINAL ASSEMBLY, TYPE 1

SCD NUMBER

MGS-3.1

SDS
ENGINEER

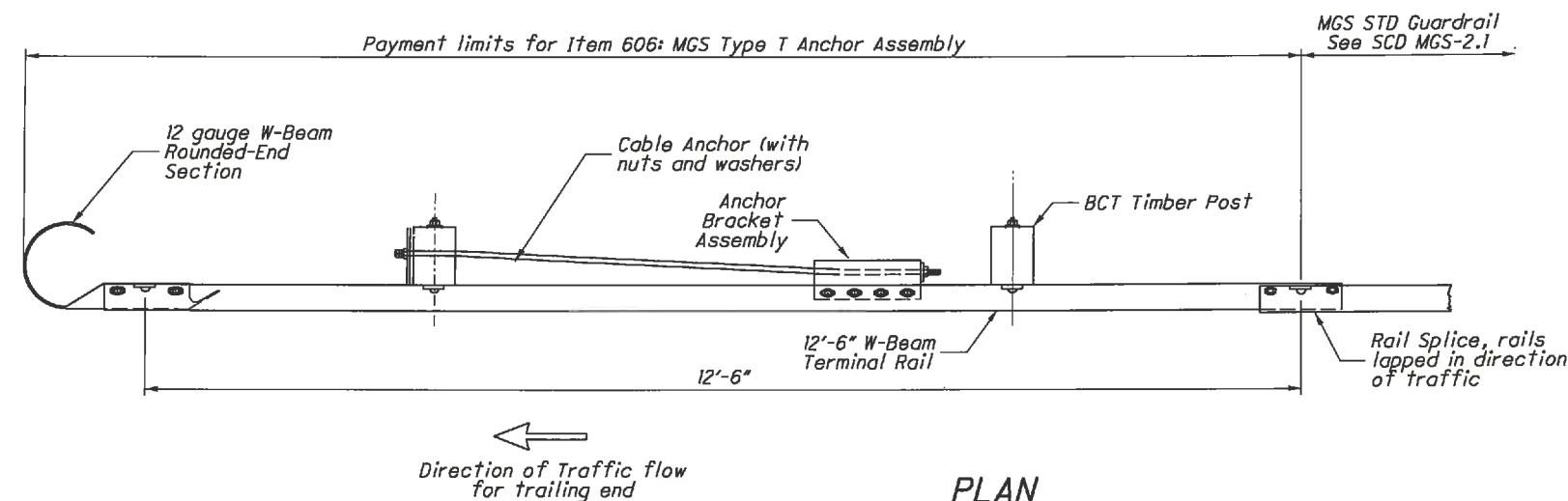
M. Ruppe

STATE OF OHIO DEPARTMENT OF
TRANSPORTATION ADMINISTRATOR

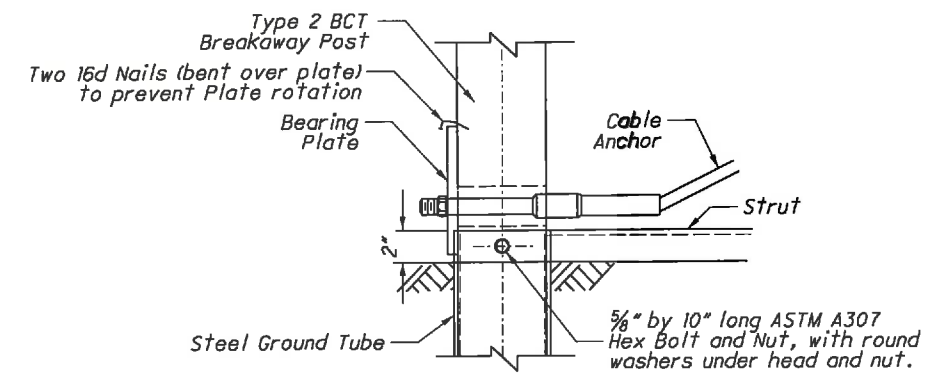
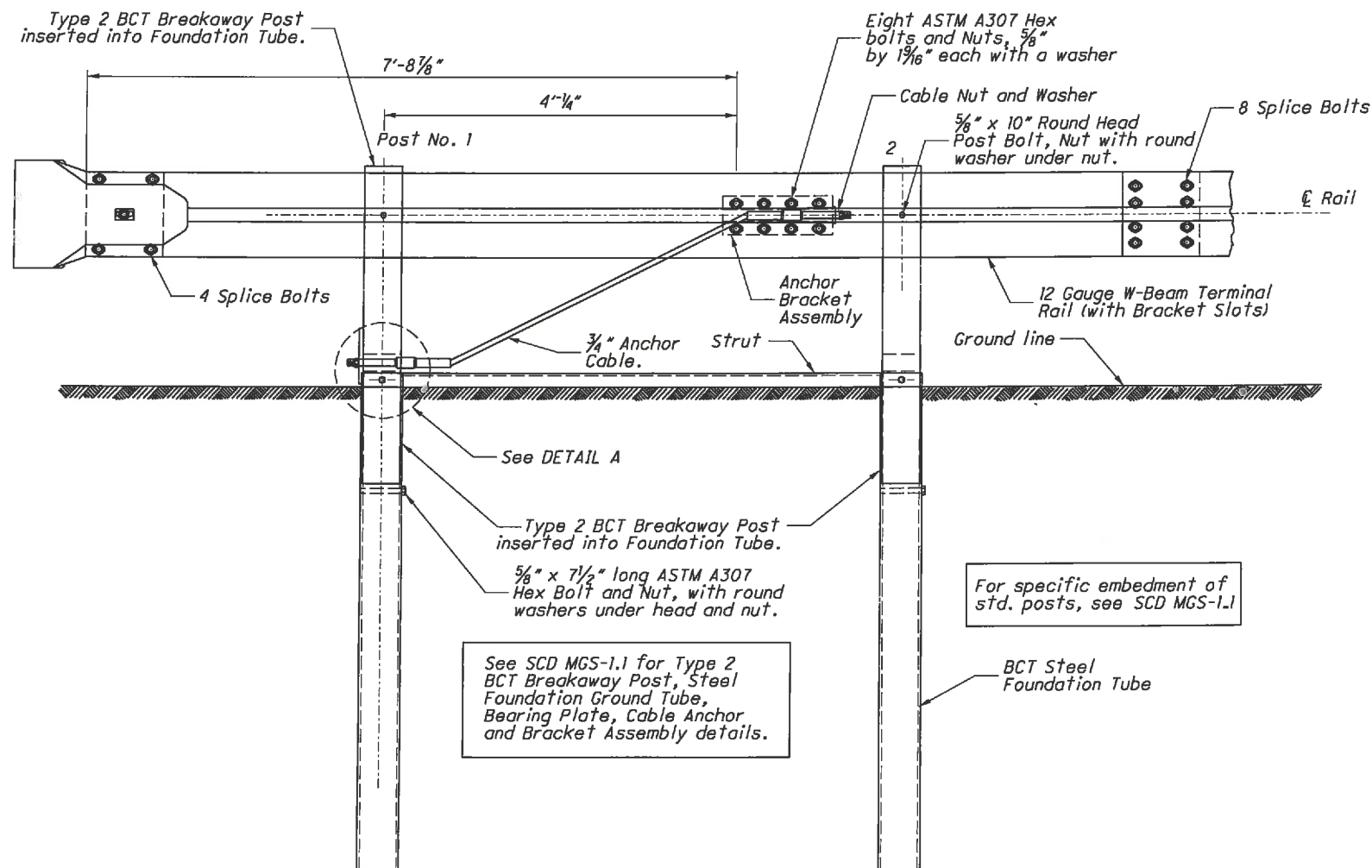
Michael Blaine

REVISION DATE

7-18-2014



PLAN



DETAIL A

NOTES

APPLICATION: Use Type T Anchor Assemblies on the trailing end of guardrail runs, located outside of the clear zone of opposing traffic. The assembly is 12'-6" long, none of which can be considered the Length of Need for the guardrail run.

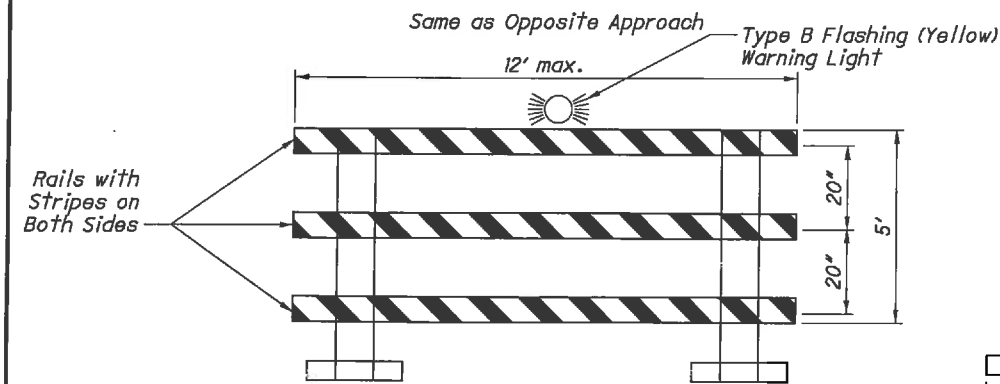
For termination requirements at driveways, and side road approaches and Terminals at Structures, see Location & Design Manual, Volume 1, Figure 603-3.

MATERIALS: See SCD MGS-1.1 for parts used on this anchor, including the Type 2 BCT Breakaway Posts, Steel Ground Foundation Tube, Bearing Plate, Cable Anchor, Bracket Assembly, and Rounded W-Beam End Section.

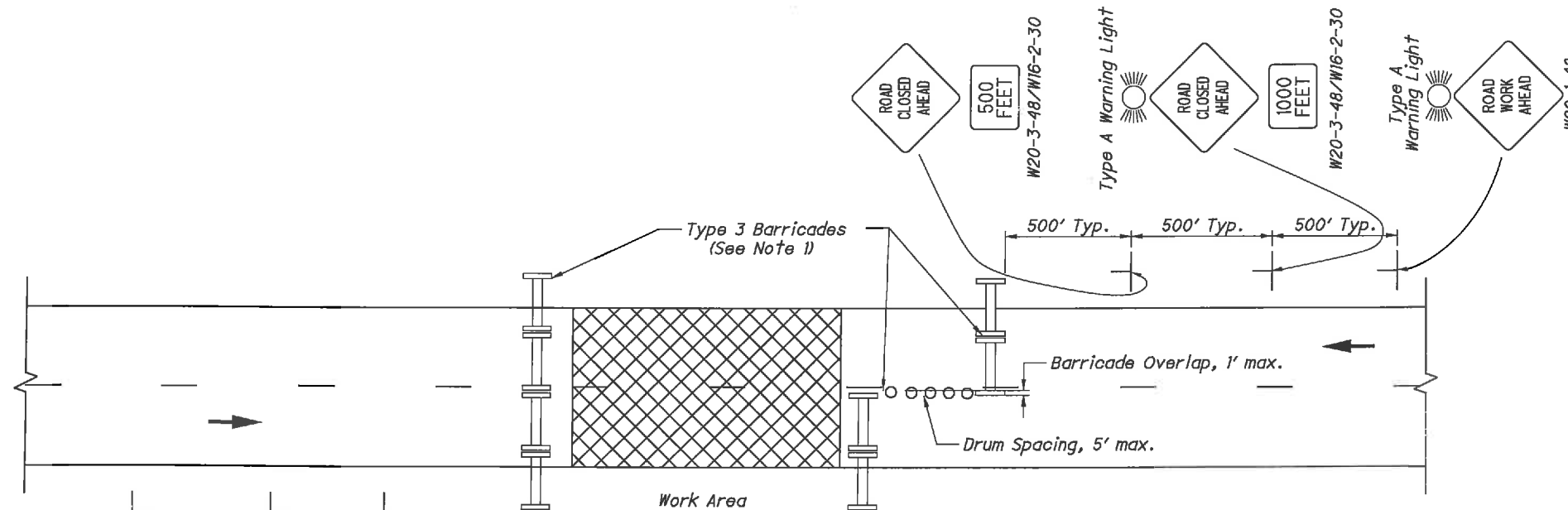
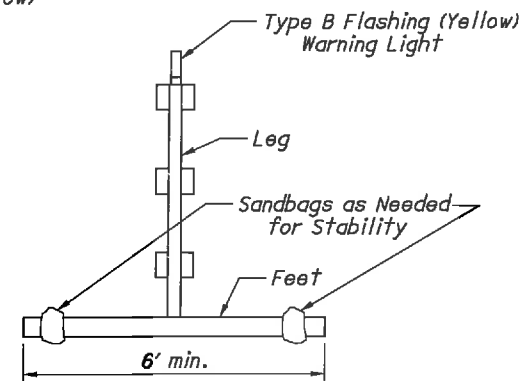
Bearing Plate is ASTM A709 Grade 36. Steel Ground Foundation Tube shall be ASTM A500, Grade B, and meet CMS 707.10. All angles, channels and plates shall meet CMS 711.01. All structural steel shall be galvanized as specified in CMS 711.02. All bolt washers indicated are standard galvanized steel of the appropriate size.

For components on this anchor that are not detailed on SCD MGS-1.1, see part descriptions in the AASHTO/AGC/ARTBA Standardized Hardware Guide.

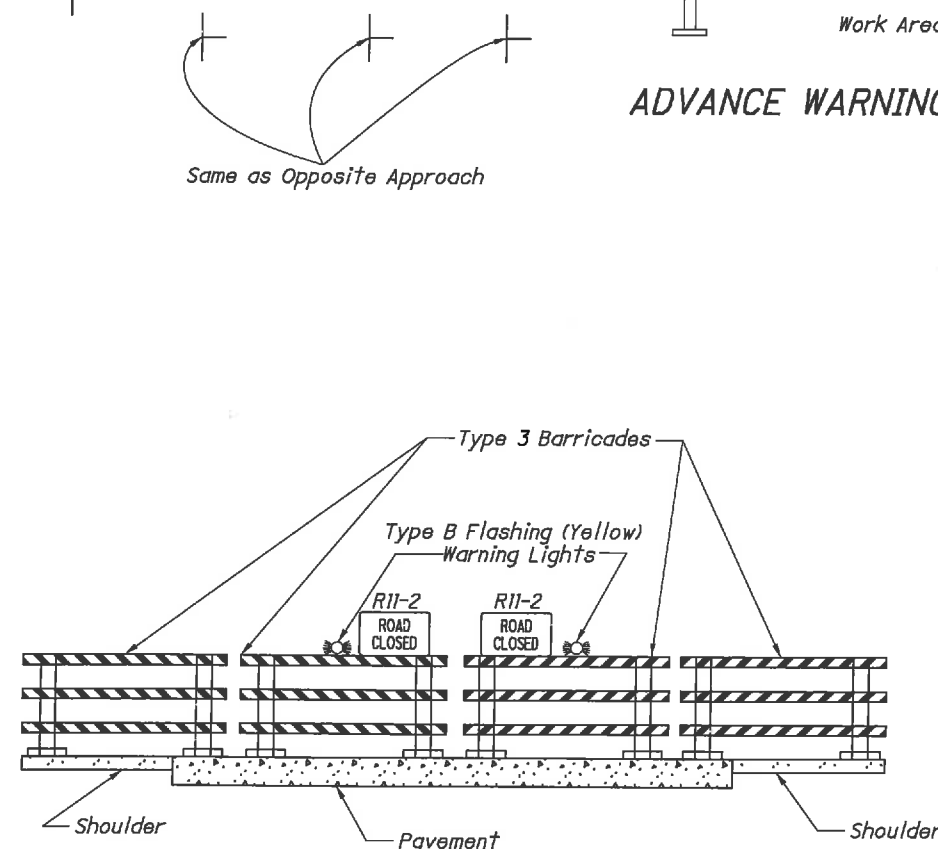
PAYMENT: All equipment, labor and materials, including the W-Beam Rounded End Section and the W-Beam Terminal Rail for the 12'-6" anchor assembly shall be included in the unit price bid for Item 606 - Anchor Assembly, MGS Type T, Each.



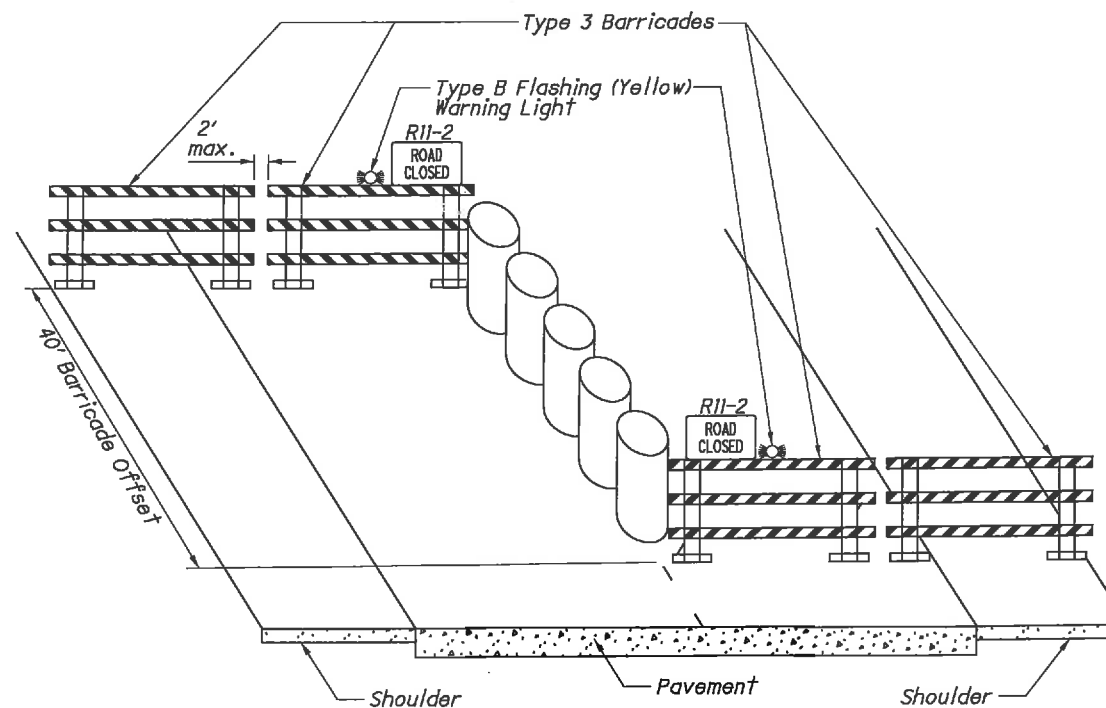
TYPE 3 BARRICADE DETAIL



ADVANCE WARNING SIGNS FOR CLOSURE



BARRICADE CLOSURE PROFILE



BARRICADE CLOSURE OFFSET OPTION

NOTES:

BARRICADE USE

- 1A. Barricades shall be NCHRP 350 compliant and shall be erected according to details shown. When the road is closed to traffic, barricades shall be used to effectively close the entire roadway, including the paved or aggregate shoulder.
- 1B. Barricades along adjacent lanes may be offset from each other as shown, with drums used to close the resulting gap. Maximum drum spacing shall be 5'.

BARRICADE REFLECTORIZATION AND COLOR

- 2A. In construction or maintenance areas, all rails of the barricades shall be reflectorized with orange and white reflectorized Type G sheeting in 6" wide alternate stripes which slope downward toward the center line of the road at an angle of 45 degrees. All three rails of the barricade shall be striped on both sides. Legs and feet shall be either all white or may display the natural color of the material used.
- 2B. Barricades used in permanent or semi-permanent application shall differ only in that they shall use red and white stripes.

SIGNS

- 3A. Where the road is closed to traffic by the erection of barricades, ROAD CLOSED (R11-2) signs shall be mounted laterally as shown.
- 3B. The advance warning signs shown on this drawing are intended for use when the traveled way is brought to an end with no direction given to traffic. Where traffic has been directed from the permanent roadway at or just in advance of the barricades, advance signing should be provided as shown in Standard Construction Drawing MT-95.70 or Ohio Manual of Uniform Traffic Control Devices Figure 6H-7 as appropriate.
- 3C. Advance warning signs approaching a lane closure, as shown on these plans, shall consist of two ROAD CLOSED AHEAD (W20-3) signs with distance plaques placed about 500' and 1000' from the closure, and a ROAD WORK AHEAD (W20-1) sign placed about 1500' from the closure. The signs shall be placed on both sides of the roadway for multi-lane divided highways or when required by the plans.

FLASHING WARNING LIGHTS

- 4A. Type A flashing warning lights are required on the ROAD WORK AHEAD (W20-1) sign and on the first ROAD CLOSED AHEAD (W20-3) sign.
- 4B. Type B flashing warning lights shall be provided on Type 3 Barricades, one light per each closed lane. Each light shall be conspicuously visible at all distances up to 1000' under normal atmospheric conditions. The light shall be in operation at all times during the period the highway is closed.

OPERATION ON 2-LANE, 2-WAY ROADWAYS

- 5A. Where the barricade runs across the entire roadway without longitudinally offsetting sections, the Contractor will normally open only the left side of the barricade as necessary to allow the construction vehicle to enter, and then shall immediately close it. The entire barricade will not normally be opened at the same time. The Contractor shall assign an employee to assure that the barricade is closed at the end of each workday.
- 5B. Where the sections of the barricade are offset from each other with drums provided to close the gap (see note 1B), the Contractor may move the drums as necessary to allow the construction vehicle to enter, and then shall immediately replace the drums. The Contractor shall assign an employee to assure that the drums are in place at the end of each workday.

TEMPORARY SIGN SUPPORT REQUIREMENTS

PLACEMENT OF SIGNS

- 1A. Lateral placement to nearest edge of signs shall be as follows:
- a) On the right side of the road for approaching traffic (except for dual-mounted signs and signs designated in the plans for left-side mounting).
 - b) Curbed roadway - minimum 2' behind face of curb.
 - c) Uncurbed roadway - 12' from edge of traffic lane or 6' from edge of paved or useable shoulder, whichever is greater.
 - d) Behind guardrail or portable barrier - See table

SIGN OFFSET

Barrier Type Support Class	BEHIND FACE OF GUARDRAIL	BEHIND FACE OF PORTABLE BARRIER
Class A Supports	2' Preferred 1' Minimum	1' Minimum*
Class B Supports	6.5' Minimum	1' Minimum*

*unless barrier top mounting is required by the plans

- 1B. Vertical clearance of signs, as measured from near side roadway edge, shall be as follows:
- a) Rural - 5' when parked cars, construction equipment, etc. will not obscure sign visibility.
 - b) Rural areas with parked cars or construction equipment - 7'
 - c) Urban - 7'
 - d) Care shall be taken to assure that signs will not be obscured by construction equipment, trees, weeds or other obstacles. Brush, weeds or grass within the right-of-way shall be trimmed as necessary.
 - e) For signing which will remain for three days or less, minimum vertical clearance shall be 1' from the roadway to bottom of sign.

CLASSES OF SUPPORTS

- 2A. The Contractor shall choose sign supports of adequate strength and with adequate foundations and anchorage to support the sign sizes erected. Sign supports which fail under typical wind load conditions shall be immediately modified or replaced with a support of adequate strength.
- 2B. All temporary sign supports shall be of the following types:

CLASS A:

Class A supports shall include the following:

- a) All No. 2 and No. 3 posts when installed singly or in pairs (side-by-side) according to the details of Standard Construction Drawings (SCDs) TC-41.10 and TC-41.20.
- b) Wood posts as shown in Solid Wood Posts detail.
- c) All breakaway connection beam supports, when installed according to the proper details shown on SCD TC-41.10 with a minimum clear distance between supports of 7' for supports larger than 6 x 9.
- d) Any breakaway post or post and connection which are certified as per CMS 614.03.
- e) Portable supports.

Use of Class A supports shall be required at unprotected locations on ODOT's roadway system. They may also be used on other roadway systems.

CLASS B:

Class B supports shall include the following:

- a) All beam type supports without breakaway connections.
- b) Supports similar to but larger than permitted for Class A.

Class B supports shall be used only at the following locations:

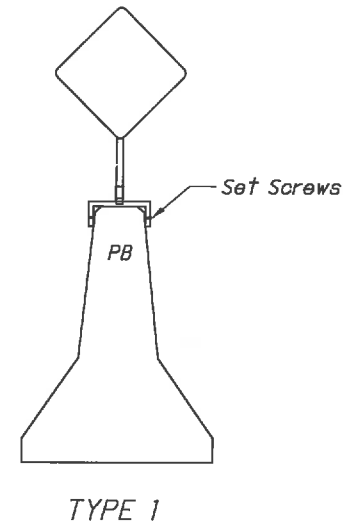
- a) Within the clear zone where protected by guardrail or concrete barrier or where positively protected from traffic such as on retaining walls.
- b) Outside the clear zone.

- 2C. All Class A and B supports shall be NCHRP 350 compliant.

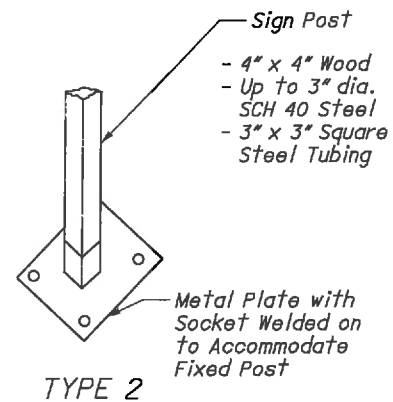
SUPPORTS AND SIGNS

- 3A. Supports for signs which will remain in place more than three days should be fixed rather than portable except in situations where the sign must rest on permanent pavement or other surface which would be damaged by insertion of post type supports.
- 3B. Portable signing, including portable supports, ballasting of the supports, and signs shall be NCHRP 350 compliant.
- 3C. Ballasting of portable supports shall be in accordance with NCHRP 350 testing of the subject support.

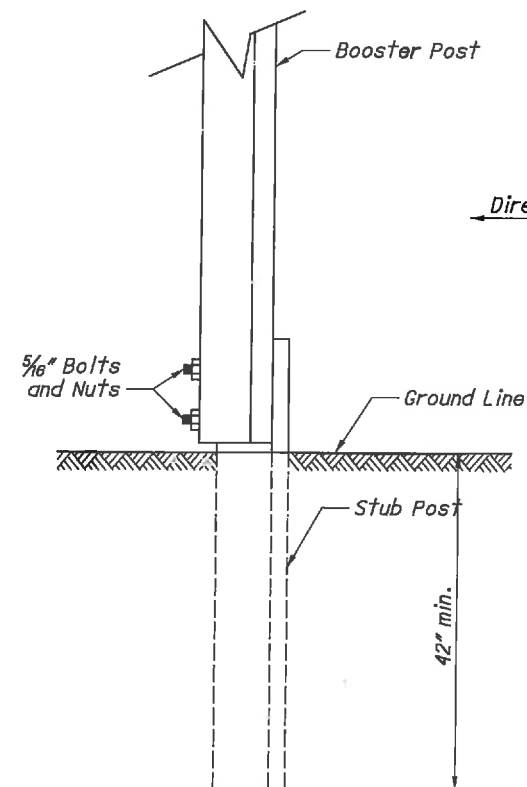
CLASS A SUPPORTS FIXED



Fasten to Top of PB
with Expansion Bolts, etc.



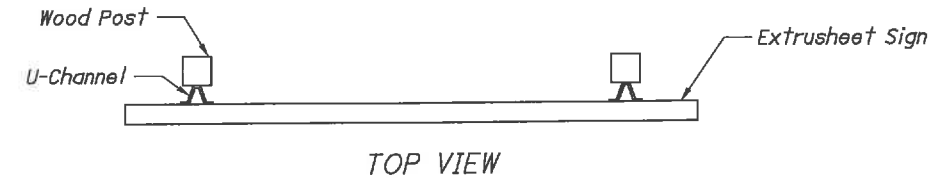
CLASS A SUPPORTS STUBBING STANDARD



NOTES:

1. For use with No. 2 or No. 3 posts.
2. Booster post shall be the same or 1 lb/ft less than stub post.
3. When the booster post is smaller than the stub post, the booster post shall be mounted in front of the stub post.
4. When the booster post is the same size as the stub post, the booster post shall be mounted behind the stub post.
5. Bolts and nuts and other fasteners shall be steel or aluminum.
6. A minimum of two bolts and nuts or other fasteners shall be used per post assembly.
7. With steel bolts, the minimum center-to-center spacing between bolts shall be 4".
8. Stub height should be limited to 4" above the ground when using the aluminum bolts for the connection.

SOLID WOOD POSTS

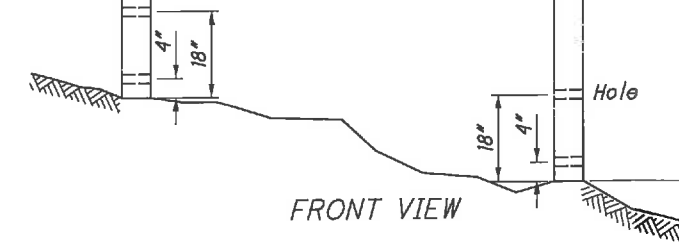


When flat sheet signing is provided, bolt the flat sheet directly to the wood posts. Do not use U-Channels.

NORMAL POST SIZE (IN)	HOLE DIAMETER (IN)	NO. OF POSTS PERMITTED IN 7' PATH IN EXPOSED LOCATIONS	MINIMUM RECOMMENDED EMBEDMENT DEPTH (FT)
4 X 4	NONE	2	3.5
4 X 6	1 1/2	2	4
6 X 6	2	1	4.5
6 X 8	3	1	5

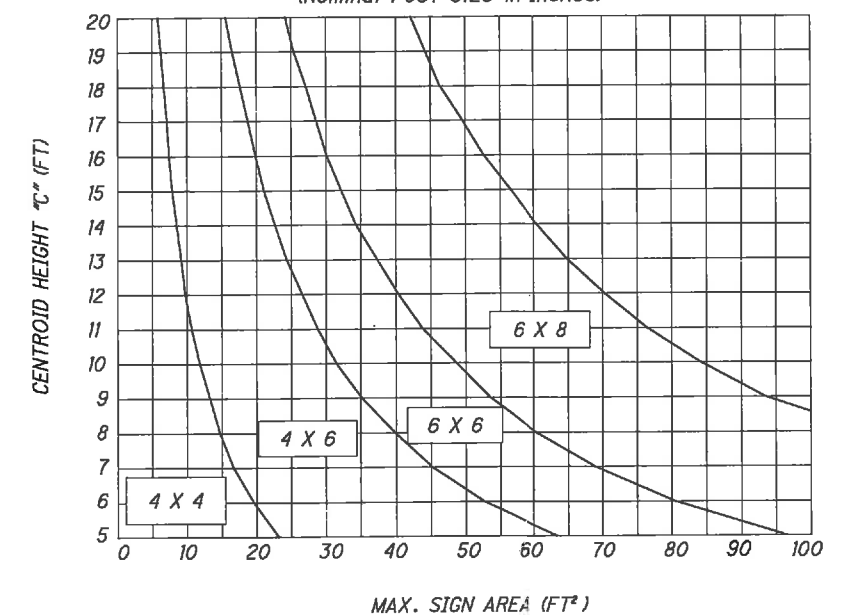
Holes Centered and Drilled Perpendicular to Roadway Centerline

7' min. Clear For 6" x 6" and 6" x 8" Posts



DESIGN CHART FOR WOOD POSTS TWO-POST INSTALLATIONS

(Nominal Post Size in Inches)



THIS DRAWING REPLACES MT-105.10 DATED 07-20-2012.

MT-105.10

TEMPORARY SIGN SUPPORT

OFFICE OF
ROADWAY
ENGINEERING

STDS.
ENGINEER

Stargell

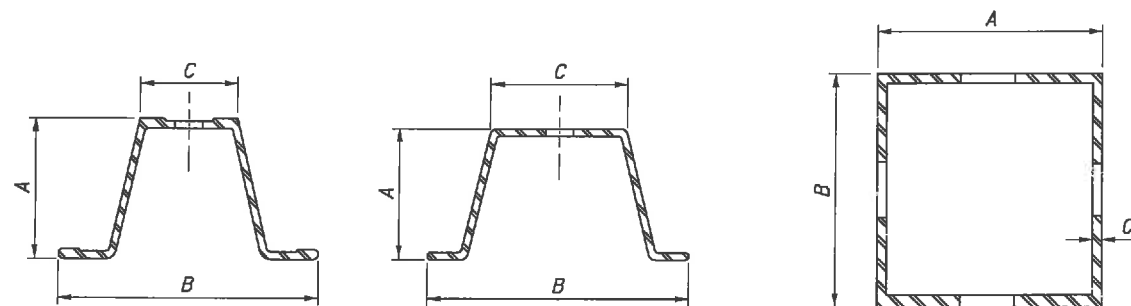
STATE OF OHIO DEPARTMENT OF TRANSPORTATION

Michael Blane

ADMINISTRATOR

7-19-2013

DATE

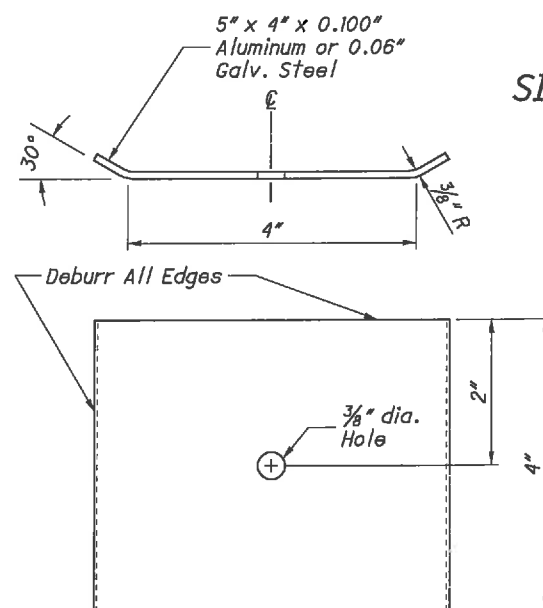


TYPE P

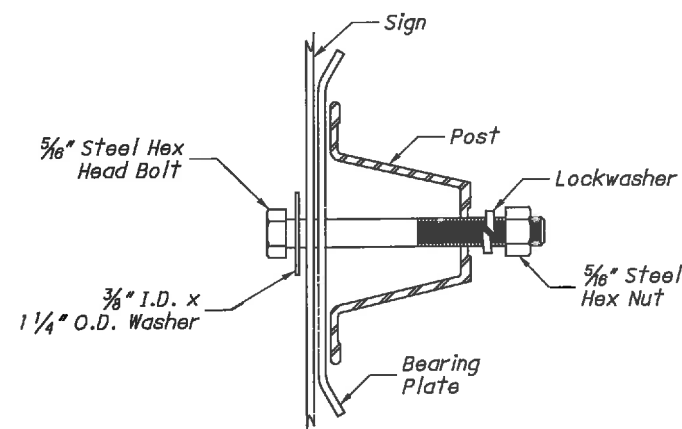
TYPE F

TYPE S

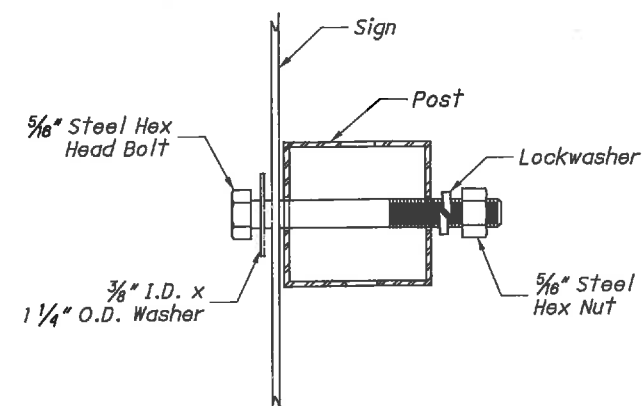
POST NO.	TYPE	LB/FT	POST DIMENSIONS (INCHES)			ANCHOR DIMENSIONS			# OF POSTS PERMITTED IN 7' PATH IN EXPOSED LOCATIONS
			A	B	C	A	B	C	
1	F	1.12	0.875	2.063	0.813				2
2	P	2.00	1.469	3.063	1.281				2
	F	2.00	1.516	3.125	1.250				2
3	S		1.750	1.750	0.083	2.000	2.000	0.105	2
	P	3.00	1.875	3.500	1.313				2
	F	3.00	1.750	3.500	1.625				2
4	S		2.00	2.00	0.083	2.250	2.250	0.105	2
	P	4.00	TWO NO.2 POST						0
	F	4.00	TWO NO.2 POST						0
6	S		2.500	2.500	0.105	3.000	3.000	0.188	1
	P	6.00	TWO NO.3 POST						0
	F	6.00	TWO NO.3 POST						0



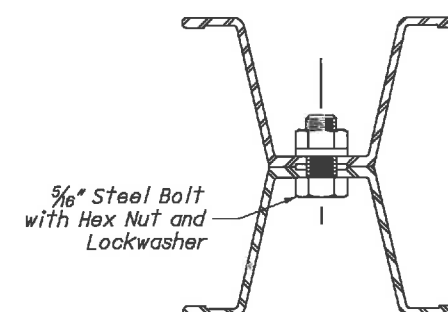
BEARING PLATE



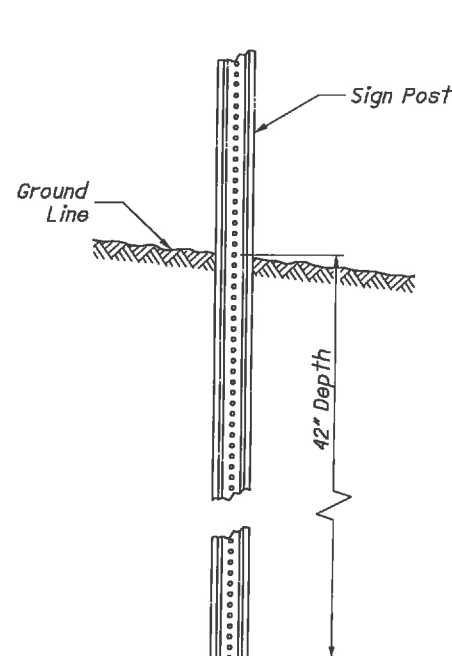
U-CHANNEL
SIGN ATTACHMENT DETAIL



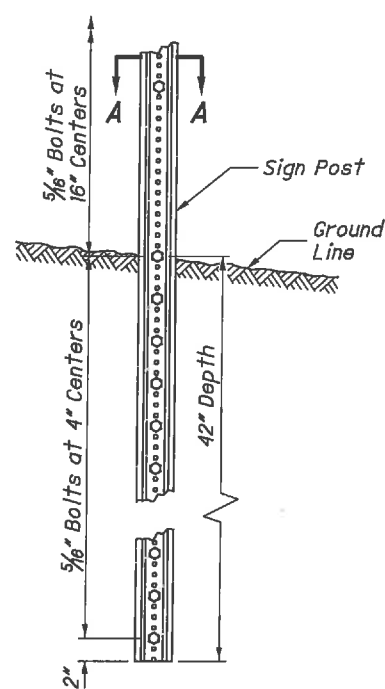
SQUARE POST
SIGN ATTACHMENT DETAIL



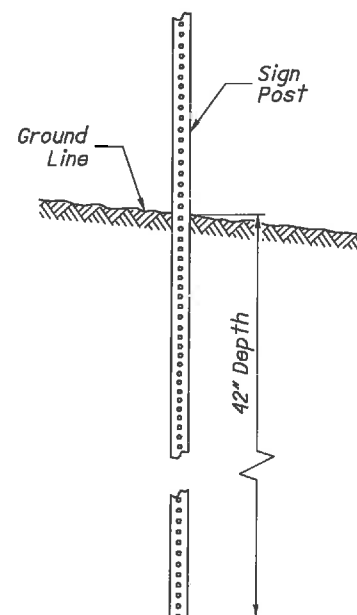
SECTION A-A



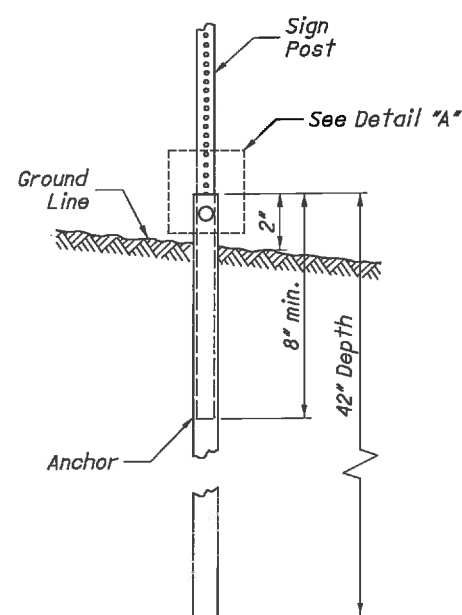
TYPICAL NO. 1, NO. 2
AND NO. 3 U-CHANNEL
DRIVEN INSTALLATION



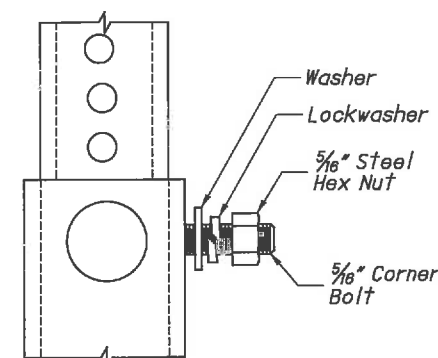
TYPICAL NO. 4 AND
NO. 6 U-CHANNEL
DRIVEN INSTALLATION



TYPICAL SQUARE POST
DRIVEN INSTALLATION



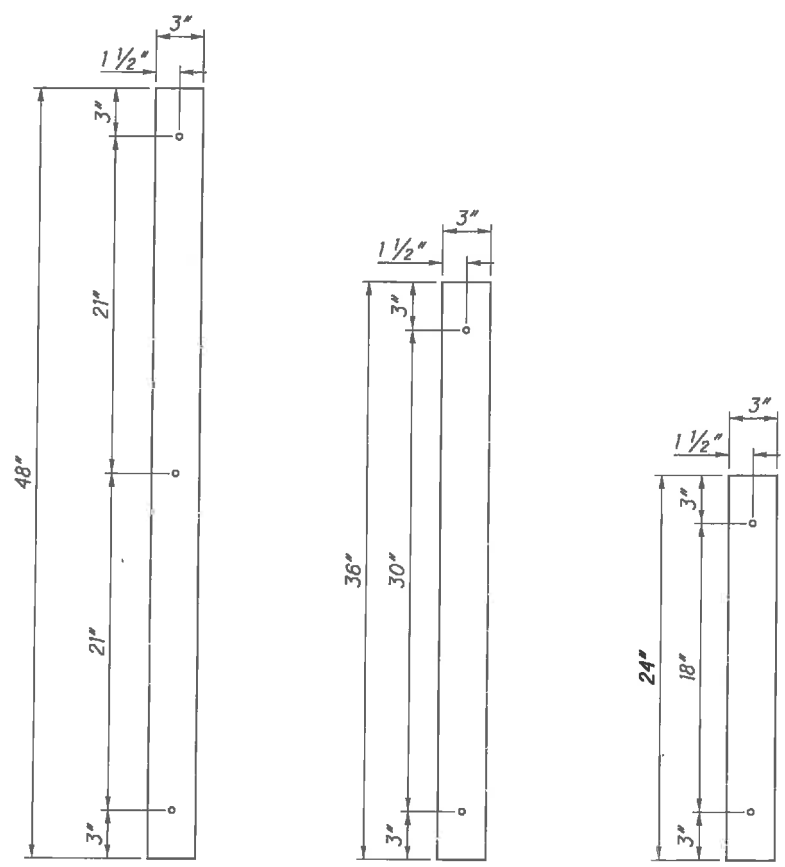
TYPICAL SQUARE POST ANCHOR
BASE INSTALLATION



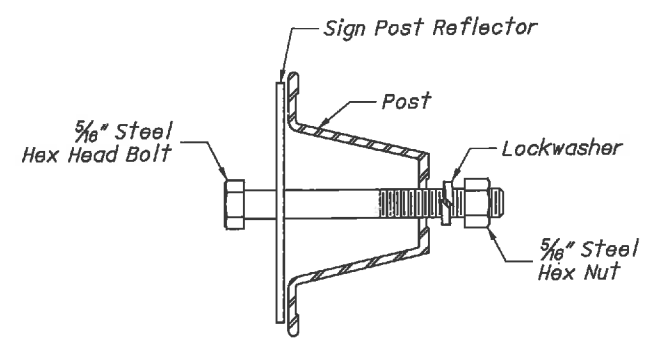
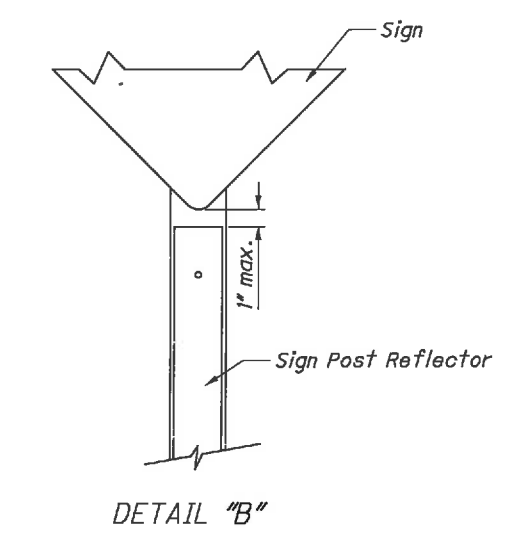
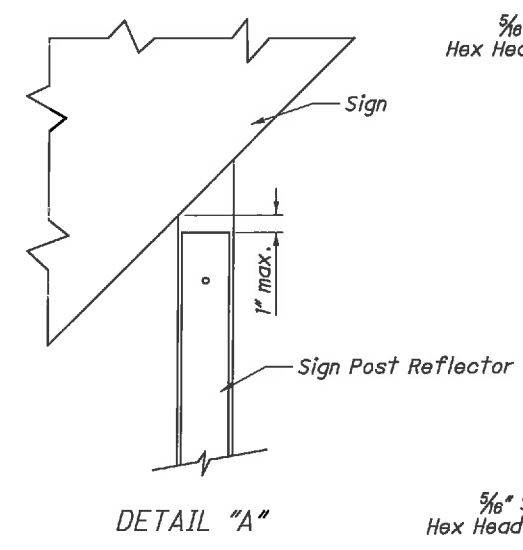
DETAIL "A"

NOTES:

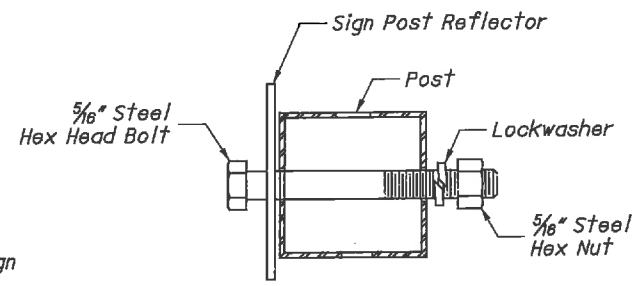
1. Install No. 4 type P and F posts, and No. 6 type P and F posts, only in protected locations (e.g., behind guardrail). Install two post installations of number 4 type S posts within 7 foot path only in protected locations.
2. Use of anchor base with No. 2 and No. 3 square post is optional. Use of anchor base with No. 4 square post is required.
3. Square post may have die-cut knockouts or open holes.



SIGN POST REFLECTORS
FRONT VIEW



U-CHANNEL
ATTACHMENT DETAIL



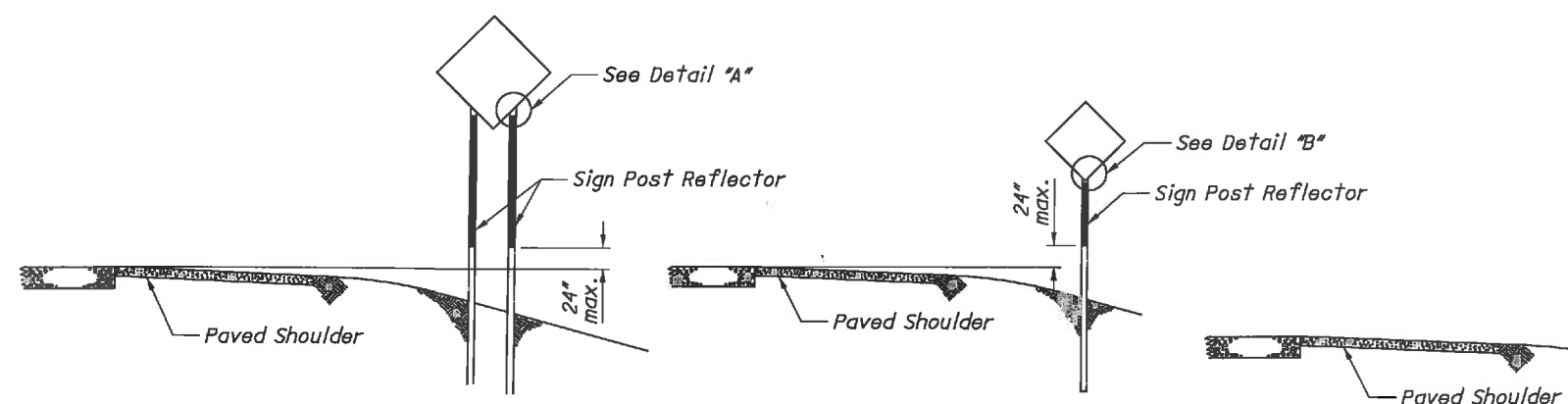
SQUARE POST
ATTACHMENT DETAIL

NOTES:

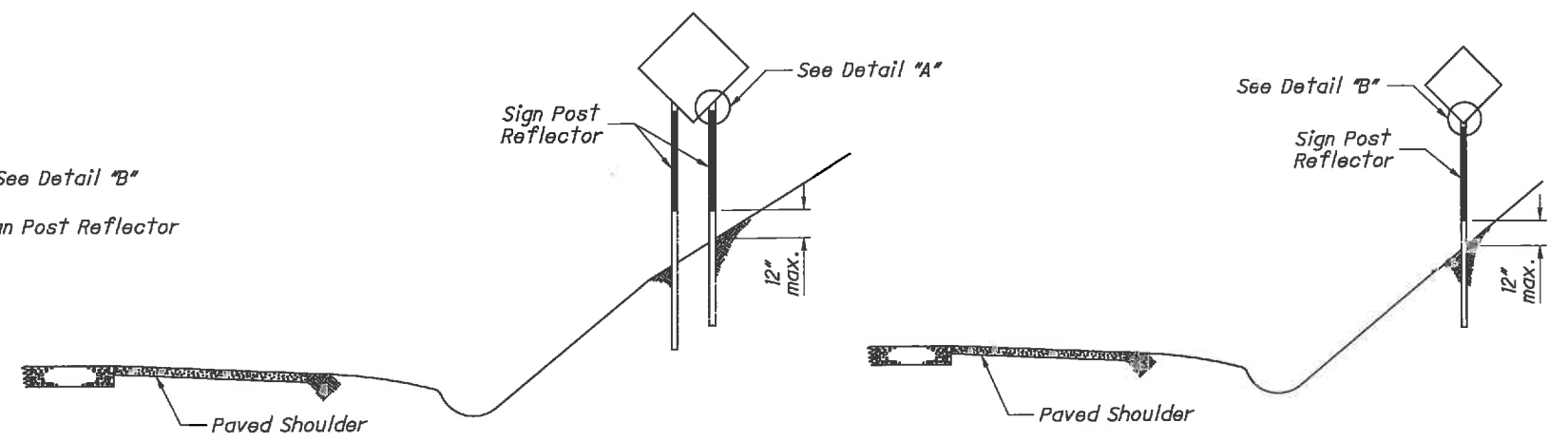
1. Fabricate sign post reflectors out of 0.080" thick flat sheet aluminum. Drill or punch 3/8" diameter bolt holes to a tolerance between holes of $\pm 1/32$ ". Apply reflective sheeting to the surface of the aluminum.
2. Reflectorize the sign post from within 1" of the bottom of the sign down to 24" above the near edge of pavement or lower, using any combination of the standard lengths shown (see Table). Where this cannot be achieved due to the local ground profile, reflectorize the post to within 12" of the ground.
3. When using multiple sections of sign post reflector to achieve the required length of reflectorization, do not leave gaps between sections. The sign post reflectorization should appear as a continuous strip.
4. Do not allow the sign post reflector to overlap the sign.
5. For multiple post installations, install the same length sign post reflector on each post.
6. For back-to-back installations of signs requiring sign post reflectorization, install sign post reflectors on both sides of the posts.
7. Install sign post reflectors matching the background color of the sign, except that the color of the reflector for the YIELD (R1-2) and DO NOT ENTER (R5-1) signs shall be red.

ACTUAL SIGN MOUNTING HEIGHT *	MINIMUM LENGTH SIGN POST REFLECTORIZATION
Up to 6'	4'
Over 6' to 7'	5'
Over 7' to 8'	6'
Over 8' to 9'	7'
Over 9' up 10'	8'
Over 10'	See note 3

* Not the minimum allowable sign mounting height



TYPICAL INSTALLATION DETAILS



INSTALLATION DETAILS FOR CUT SECTION
(See Note 3)

THIS DRAWING REPLACES TC-41.30 DATED 01-19-2007.

STANDARD ROADWAY CONSTRUCTION DRAWING

TC-41.30

SIGN POST REFLECTORS

OFFICE OF
ROADWAY
ENGINEERING

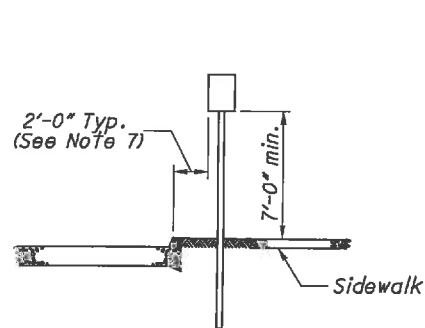
STATUS:
ENGINEER

H. Suter

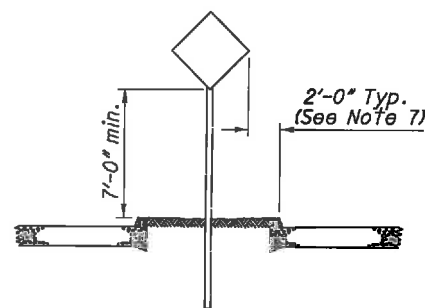
STATE OF OHIO DEPARTMENT OF TRANSPORTATION

ADMINISTRATOR

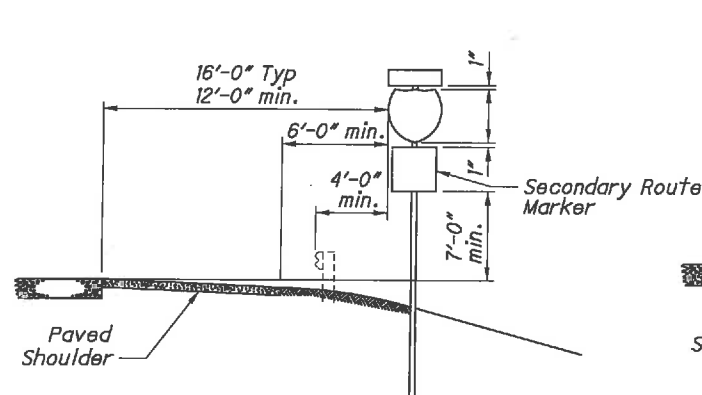
10-18-2013
DATE



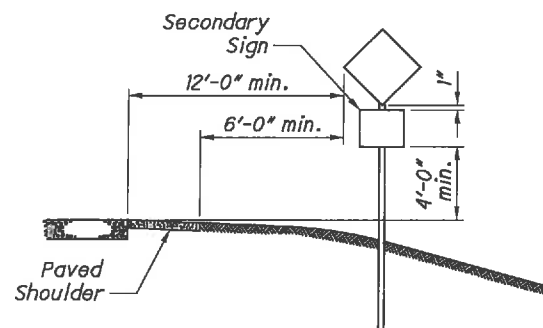
URBAN-RESIDENTIAL AND BUSINESS
AND ALL AREAS WITH SIDEWALKS



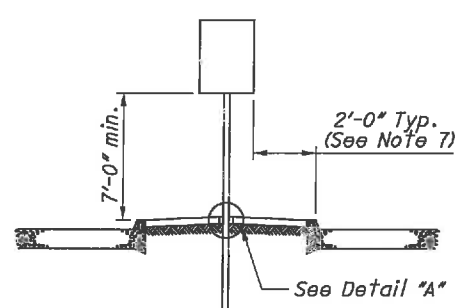
MEDIAN



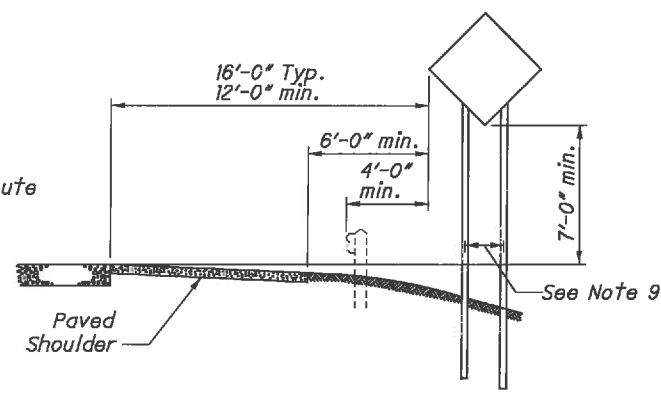
EXPRESSWAY OR FREEWAY
WITH SECONDARY SIGN



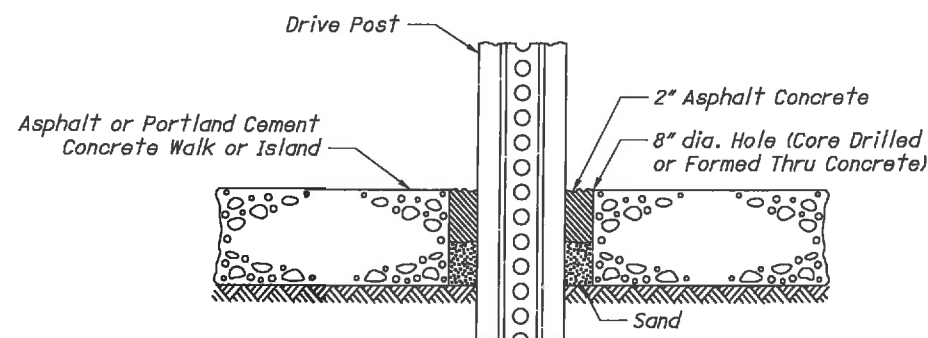
RURAL
WITH SECONDARY SIGN



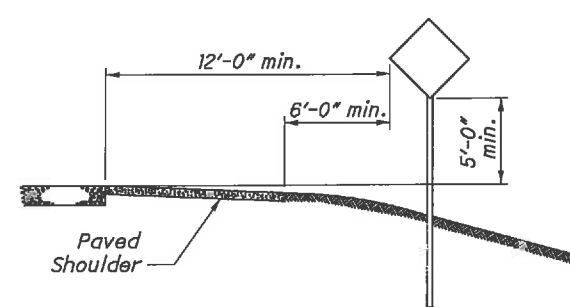
PAVED MEDIAN



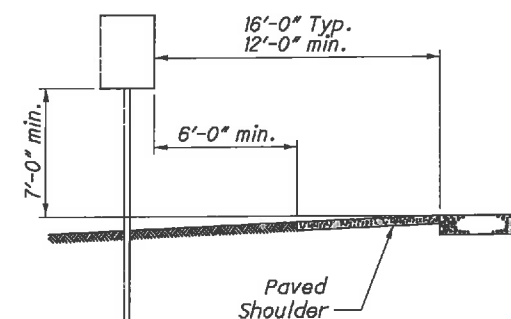
EXPRESSWAY OR FREEWAY



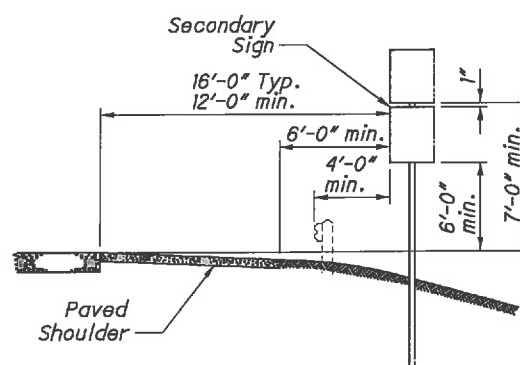
DETAIL "A"



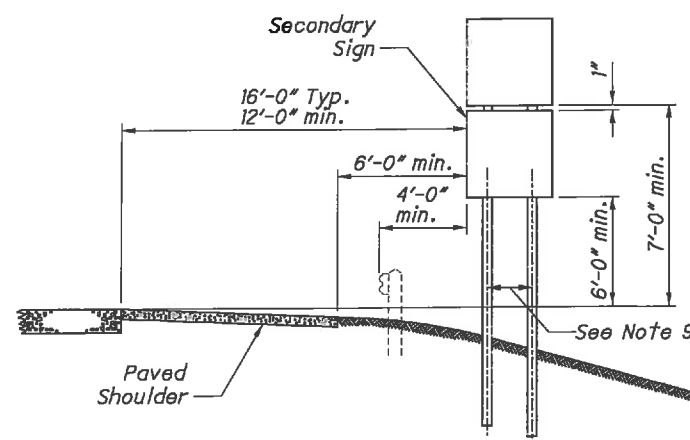
RURAL



MEDIAN - EXPRESSWAY OR FREEWAY



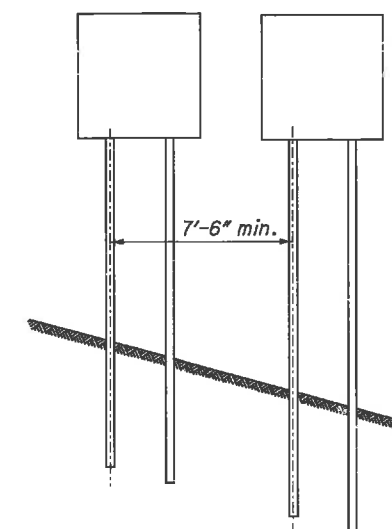
EXPRESSWAY OR FREEWAY
WITH SECONDARY SIGN



EXPRESSWAY OR FREEWAY
WITH SECONDARY SIGN

NOTES:

1. See Standard Construction Drawing (SCD) TC-41.20 for details on yielding supports.
2. All signs shall be placed 90° to the roadway, except as described in notes 3 and 4 below.
3. Install chevron alignment and one-direction large arrow signs on the outside of a turn or curve in line with and at approximately 90° to approaching traffic flow.
4. Install parking signs with arrows at an angle of not less than 30° nor more than 45° with the line of traffic flow.
5. Install chevron alignment signs at a minimum mounting height of 4' above the near edge of the traveled way.
6. Install object markers at a minimum mounting height of 4' above the near edge of the traveled way for obstructions 8' or less from the edge of shoulder or curb. Install object markers at a minimum mounting height of 4' above the ground for obstructions more than 8' from the edge of the shoulder or curb.
7. Install signs with a minimum lateral offset of 1' from the face of curb where sidewalk width is limited or where existing poles are close to the curb.
8. On conventional roads where it is impractical to locate a sign with the lateral offsets shown, install signs with a minimum lateral offset of 2'.
9. See SCDs TC-52.10 and TC-52.20 for dimensions between supports.



ADJACENT SIGN INSTALLATION
FOR NO. 2 AND NO. 3 YIELDING POST
SUPPORTS IN EXPOSED LOCATIONS

THIS DRAWING REPLACES TC-42.20 DATED 01-21-2011.

SCD NUMBER

TC-42.20

TYPICAL FLAT SHEET SIGN PLACEMENT

**OFFICE OF
ROADWAY
ENGINEERING**

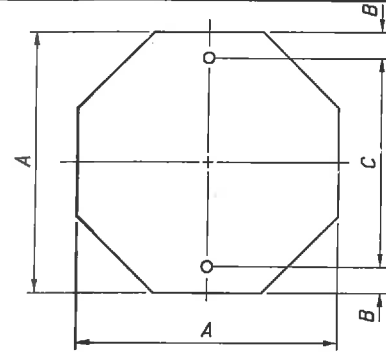
SDS:
ENGINEER

H. Suter

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

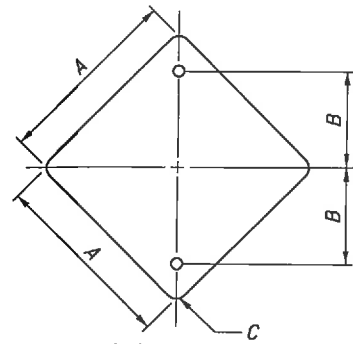
ADMINISTRATOR

10-18-2013
DATE



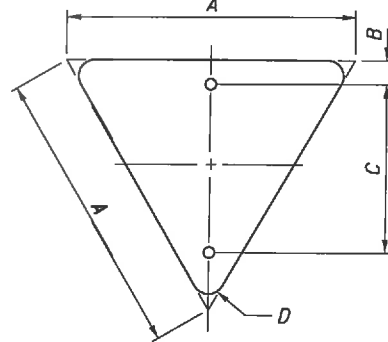
OCTA-1-2

A	B	C	THICKNESS	AREA (FT ²)
18	3	12	0.080	2.25
24	3	18	0.080	4.00
30	3	24	0.080	6.25
36	3	30	0.080	9.00



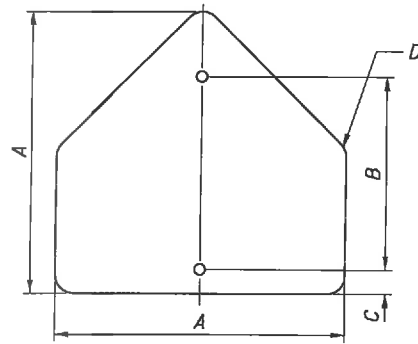
DIA-1-2

A	B	C	THICKNESS	AREA (FT ²)
18	9	1.5	0.080	2.25
24	12	1.5	0.080	4.00
30	15	1.875	0.080	6.25
36	18	2.25	0.080	9.00



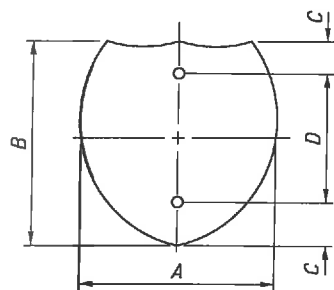
TRI-1-2

A	B	C	D	THICKNESS	AREA (FT ²)
24	2	14	1.5	0.080	1.73
30	3	18	1.5	0.080	2.71
36	3	21	2	0.080	3.90



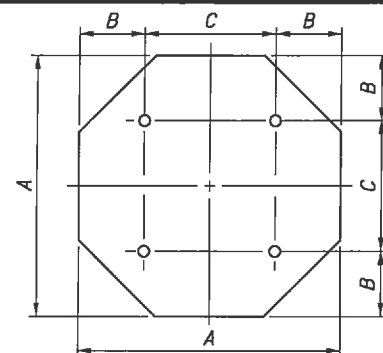
PENT-1-2

A	B	C	D	THICKNESS	AREA (FT ²)
30	21	3	1.875	0.080	6.25
36	24	3	2.25	0.080	9.00



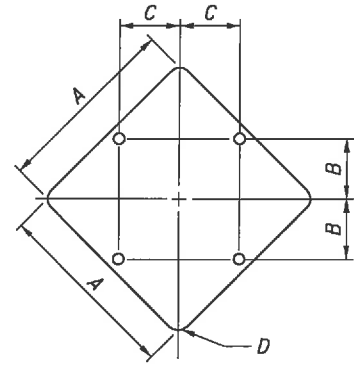
I.S.-1-2

A	B	C	D	THICKNESS	AREA (FT ²)
24	24	3	18	0.080	4.00
24	30	3	18	0.080	5.00
30	30	3	24	0.080	6.25
37.5	30	3	24	0.080	7.81
36	36	6	24	0.080	9.00
45	36	6	24	0.080	11.25



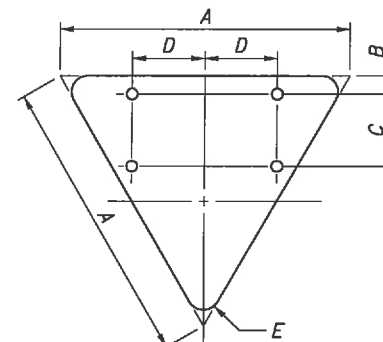
OCTA-2-4

A	B	C	THICKNESS	AREA (FT ²)
48	9	30	0.100	16.00



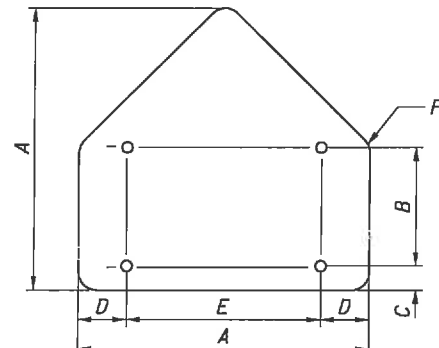
DIA-2-4

A	B	C	D	THICKNESS	AREA (FT ²)
48	15	15	3	0.100	16.00
60	18	18	3.75	0.100	25.00



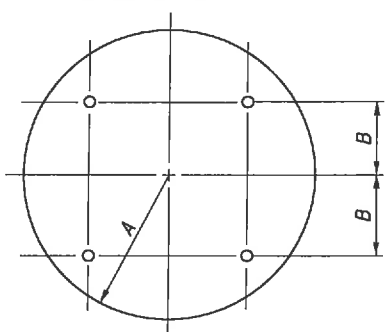
TRI-2-4

A	B	C	D	E	THICKNESS	AREA (FT ²)
48	3	12	12	3	0.100	6.93
60	3	18	15	4	0.100	10.83



PENT-2-4

A	B	C	D	E	F	THICKNESS	AREA (FT ²)
48	18	6	9	30	3	0.100	16.00



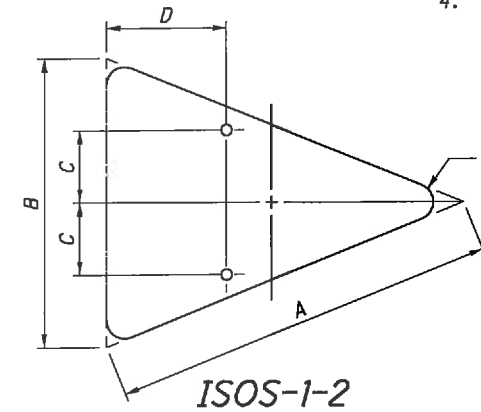
CIR-2-4

A	B	THICKNESS	AREA (FT ²)
24	15	0.100	16.00

Shape OCTA-2-4
No. Bolts Required
No. Supports Required

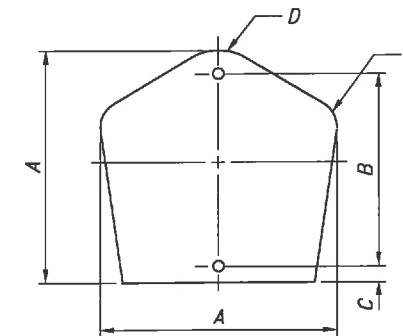
NOTES:

1. All bolt holes shall be $\frac{3}{8}$ " in diameter, and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of $\pm \frac{1}{32}$ ".
3. All route shields shall be 0.080" thick and attached to extrusheet signs with aluminum blind rivets.
4. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.



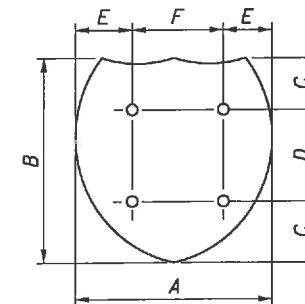
ISOS-1-2

A	B	C	D	E	THICKNESS	AREA (FT ²)
40	30	7.5	12	1.875	0.080	3.86
48	36	9	15	2.25	0.100	5.56



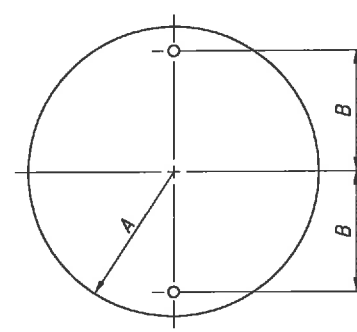
CO-1-2

A	B	C	D	E	THICKNESS	AREA (FT ²)
18	15	1	5	2	0.080	2.25
24	18	2	5.313	2.688	0.080	4.00
30	24	2	6.625	3.375	0.080	6.25



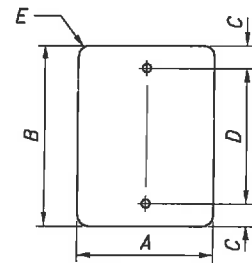
I.S.-2-4

A	B	C	D	E	F	THICKNESS	AREA (FT ²)
48	48	9	30	9	30	0.100	16.00
60	48	9	30	12	36	0.100	20.00

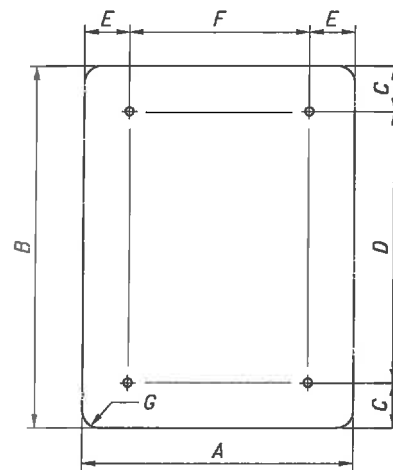


CIR-1-2

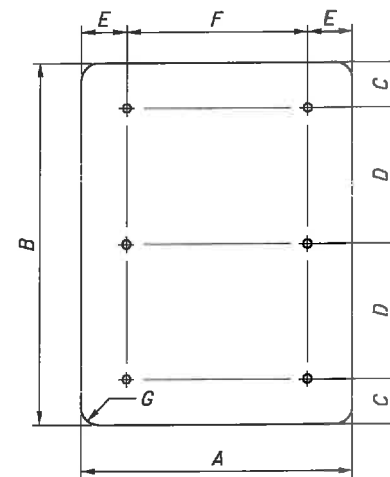
A	B	THICKNESS	AREA (FT ²)
9	6	0.080	2.25
12	9	0.080	4.00
15	12	0.080	6.25
18	15	0.080	9.00



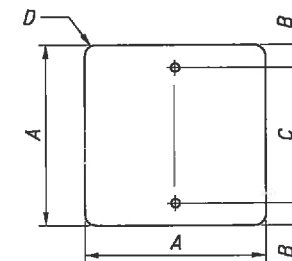
V-REC-1-2



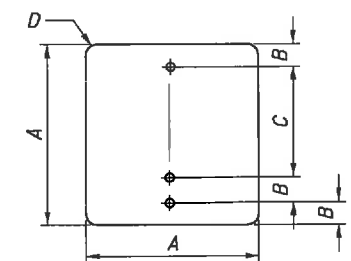
V-REC-2-4



V-REC-2-6



SQ-1-2



SQ-1-3
(MAINTENANCE MARKER)

NOTES:

1. All bolt holes shall be $\frac{3}{8}$ " in diameter and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of $\pm \frac{1}{32}$ ".
3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.

A	B	C	D	E	THICKNESS	AREA (FT ²)
6	54	9	36	1.5	0.080	2.25
9	12	1.5	9	1.5	0.080	0.75
10	12	1.5	10	1.5	0.080	0.83
12	15	1.5	12	1.5	0.080	1.25
12	16	1.5	13	1.5	0.080	1.33
12	18	1.5	15	1.5	0.080	1.50
12	24	3	18	1.5	0.080	2.00
12	30	3	24	1.5	0.080	2.50
12	36	3	30	1.5	0.080	3.00
12	48	6	36	1.5	0.080	4.00
12	60	6	48	1.5	0.080	5.00
14	48	6	36	1.5	0.080	4.67
18	24	3	18	1.5	0.080	3.00
18	60	6	48	1.5	0.100	7.50
24	30	3	24	1.5	0.080	5.00
24	36	3	30	1.5	0.080	6.00
24	38	3	32	1.5	0.080	6.33
24	42	6	30	1.5	0.080	7.00
24	48	6	36	1.5	0.100	8.00
30	36	3	30	1.875	0.080	7.50
30	42	6	30	1.875	0.080	8.75
30	48	6	36	1.875	0.100	10.00

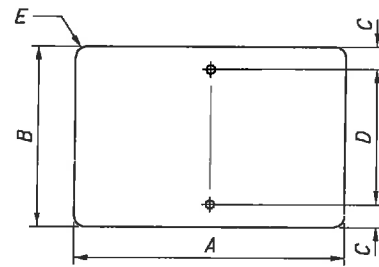
A	B	C	D	E	F	G	THICKNESS	AREA (FT ²)
36	42	6	30	6	24	2.25	0.080	10.50
36	48	6	36	6	24	2.25	0.100	12.00
36	54	6	42	6	24	2.25	0.100	13.50
36	60	6	48	6	24	2.25	0.100	15.00
36	72	12	48	6	24	2.25	0.100	18.00
36	75	13.5	48	6	24	2.25	0.100	18.75
42	60	6	48	9	24	2.25	0.100	17.50
48	60	6	48	9	30	3	0.100	20.00

A	B	C	D	E	F	G	THICKNESS	AREA (FT ²)
48	72	6	30	9	30	3	0.100	24.00
48	76	8	30	9	30	3	0.100	25.33
48	84	12	30	9	30	3	0.100	28.00
48	96	12	36	9	30	3	0.100	32.00

A	B	C	D	THICKNESS	AREA (FT ²)
6	1.0	3	1.0	0.080	0.25
9	1.0	6	1.0	0.080	0.56
12	1.5	9	1.5	0.080	1.00
15	1.5	12	1.5	0.080	1.56
16	1.5	13	1.5	0.080	1.78
18	3	12	1.5	0.080	2.25
24	3	18	1.5	0.080	4.00
30	3	24	1.875	0.080	6.25
36	3	30	2.25	0.080	9.00

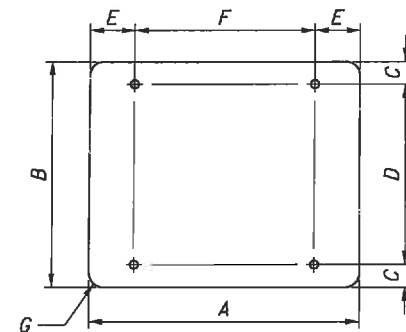
A	B	C	D	THICKNESS	AREA (FT ²)
12	1	9	1.5	0.08	1

Shape V-REC-2-4 No. Bolts Required 4
No. Supports Required 4



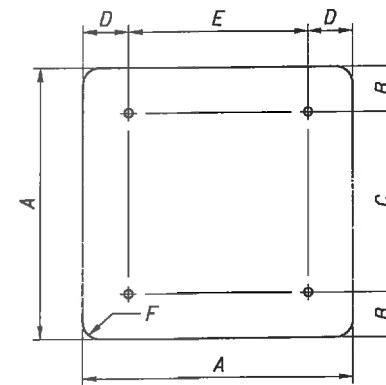
H-REC-1-2

A	B	C	D	E	THICKNESS	AREA (FT ²)
12	4	1	2	1.5	0.080	0.33
12	6	1	3	1.5	0.080	0.50
12	6.5	1	3.5	1.5	0.080	0.54
12	9	1.5	6	1.5	0.080	0.75
15	8	1.5	5	1.5	0.080	0.83
15	12	1.5	9	1.5	0.080	1.25
18	6	1	3	1.5	0.080	0.75
18	9	1.5	6	1.5	0.080	1.12
18	12	1.5	9	1.5	0.080	1.50
20	15	1.5	12	1.5	0.080	2.08
20	18	3	12	1.5	0.080	2.50
21	15	1.5	12	1.5	0.080	2.19
24	6	1	3	1.5	0.080	1.00
24	8	1.5	5	1.5	0.080	1.33
24	9	1.5	6	1.5	0.080	1.50
24	10	1.5	7	1.5	0.080	1.67
24	12	1.5	9	1.5	0.080	2.00
24	18	3	12	1.5	0.080	3.00
30	8	1.5	5	1.5	0.080	1.67
30	9	1.5	6	1.5	0.080	1.88
30	12	1.5	9	1.5	0.080	2.50
30	15	1.5	12	1.5	0.080	3.12
30	16	1.5	13	1.5	0.080	3.33
30	18	3	12	1.5	0.080	3.75
30	24	3	18	1.5	0.080	5.00
36	6	1	3	1.5	0.080	1.50
36	8	1.5	5	1.5	0.080	2.00
36	9	1.5	6	1.5	0.080	2.25
36	12	1.5	9	1.5	0.080	3.00
36	14	1.5	11	1.5	0.080	3.50
36	15	1.5	12	1.5	0.080	3.75
36	18	3	12	1.5	0.080	4.50
36	20	3	14	1.5	0.080	5.00
36	24	3	18	1.5	0.080	6.00
36	30	3	24	1.875	0.080	7.50
37.5	30	3	24	1.875	0.080	7.81
48	8	1.5	5	1.5	0.125	2.67
48	10	1.5	7	1.5	0.125	3.33
48	12	1.5	9	1.5	0.125	4.00
48	14	1.5	11	1.5	0.125	4.67
48	16	1.5	13	1.5	0.125	5.33
48	18	3	12	1.5	0.125	6.00



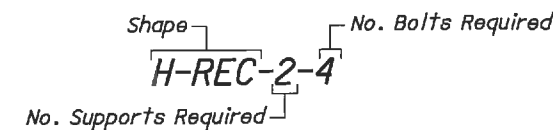
H-REC-2-4

A	B	C	D	E	F	G	THICKNESS	AREA (FT ²)
40	20	3	14	6	28	1.5	0.080	5.56
42	24	3	18	9	24	1.5	0.080	7.00
42	30	3	24	9	24	1.875	0.080	8.75
42	36	6	24	9	24	2.25	0.080	10.50
45	36	6	24	9	27	2.25	0.080	11.25
48	8	1.5	5	9	30	1.5	0.125	2.66
48	10	1.5	7	9	30	1.5	0.125	3.33
48	12	1.5	9	9	30	1.5	0.125	4.00
48	14	1.5	11	9	30	1.5	0.125	4.66
48	16	1.5	13	9	30	1.5	0.125	5.33
48	18	3	12	9	30	1.5	0.125	6.00
48	20	3	14	9	30	1.5	0.100	6.67
48	24	3	18	9	30	1.5	0.100	8.00
48	30	3	24	9	30	1.875	0.100	10.00
48	36	6	24	9	30	2.25	0.100	12.00
48	42	6	30	9	30	2.25	0.100	14.00
54	18	3	12	9	36	1.5	0.100	6.75
54	30	3	24	9	36	1.875	0.100	11.25
54	36	6	24	9	36	2.25	0.100	13.50
60	12	1.5	9	12	36	1.5	0.100	5.00
60	18	3	12	12	36	1.5	0.100	7.50
60	24	3	18	12	36	1.5	0.100	10.00
60	30	3	24	12	36	1.875	0.100	12.50
60	36	6	24	12	36	2.25	0.100	15.00
60	48	6	36	12	36	3	0.100	20.00
66	24	3	18	12	42	1.5	0.100	11.00
66	36	6	24	12	42	2.25	0.100	16.50
72	12	1.5	9	12	48	1.5	0.125	6.00
72	15	1.5	12	12	48	1.5	0.125	7.50
72	18	3	12	12	48	1.5	0.125	9.00
72	24	3	18	12	48	1.5	0.100	12.00
72	36	6	24	12	48	2.25	0.100	18.00
72	48	6	36	12	48	3	0.100	24.00
78	24	3	18	12	54	1.5	0.125	13.00



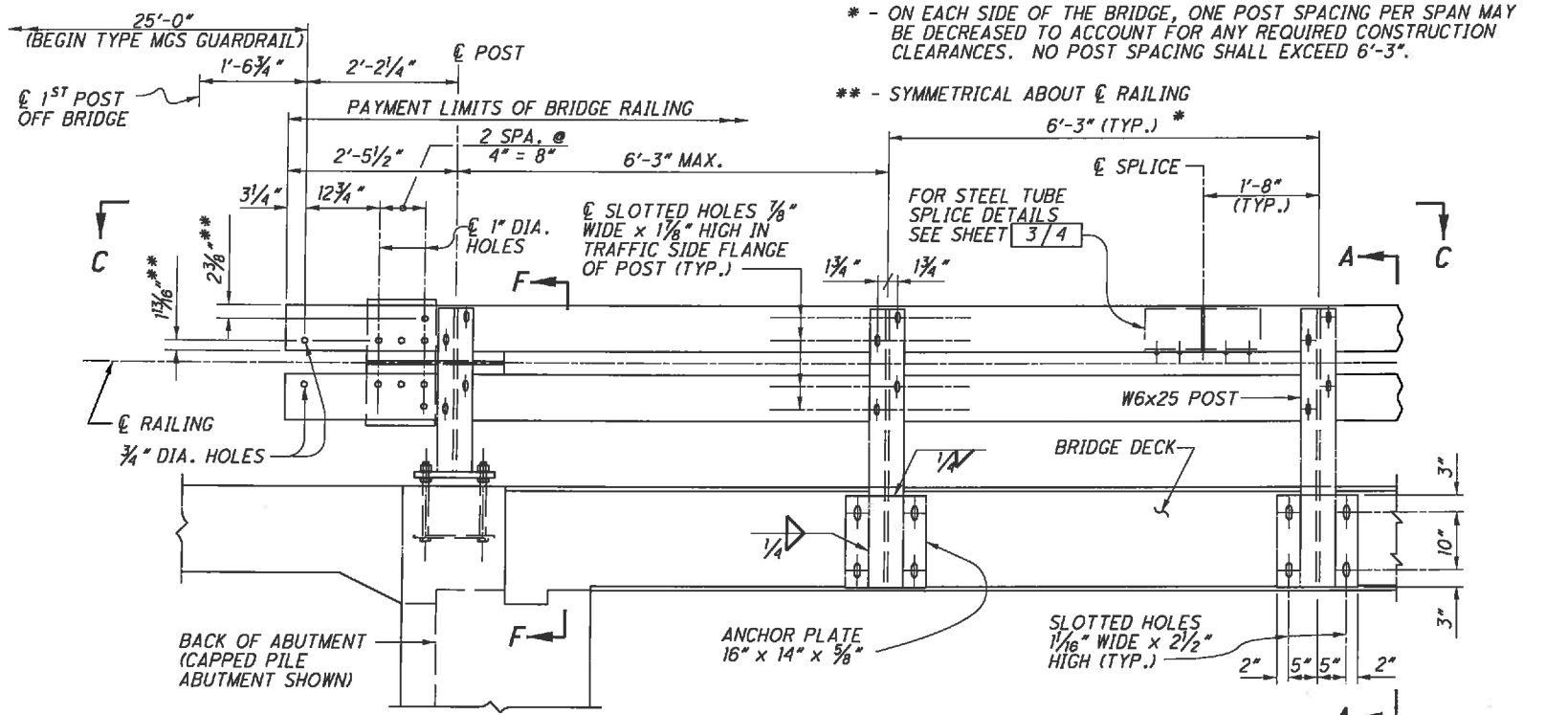
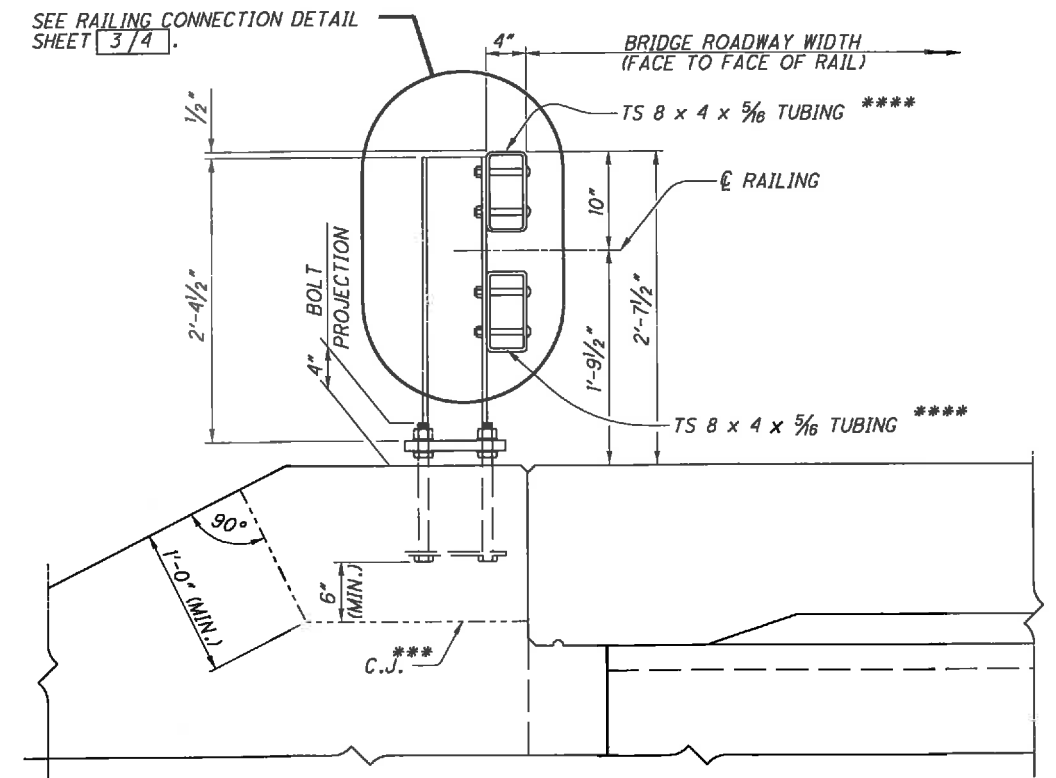
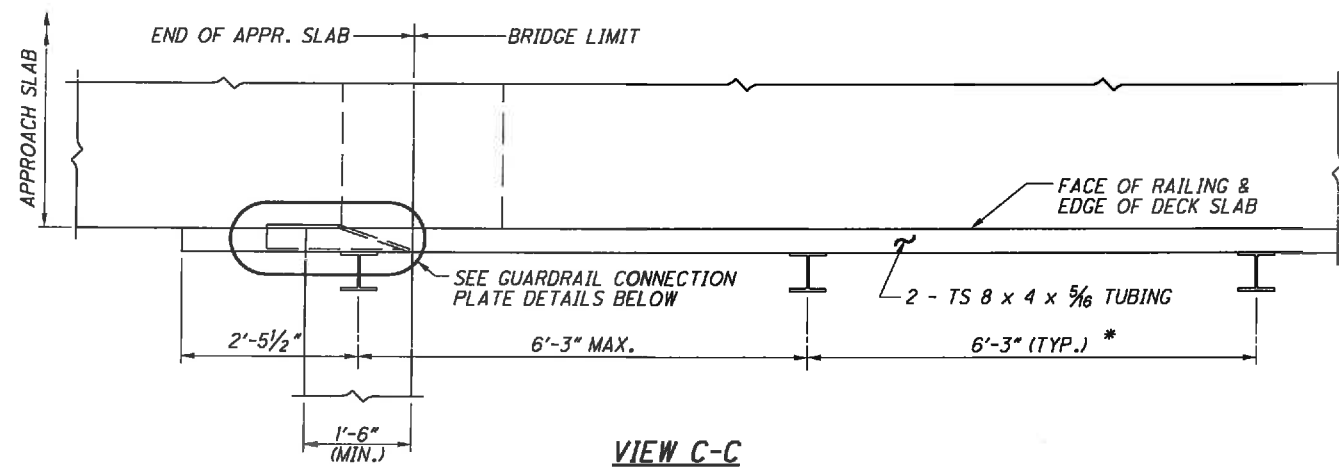
SQ-2-4

A	B	C	D	E	F	THICKNESS	AREA (FT ²)
36	6	24	6	24	2.25	0.080	9.00
42	6	30	9	24	2.25	0.080	12.25
48	6	36	9	30	3	0.100	16.00



NOTES:

1. All bolt holes shall be $\frac{3}{8}$ " in diameter and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of $\pm \frac{1}{32}$ ".
3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.

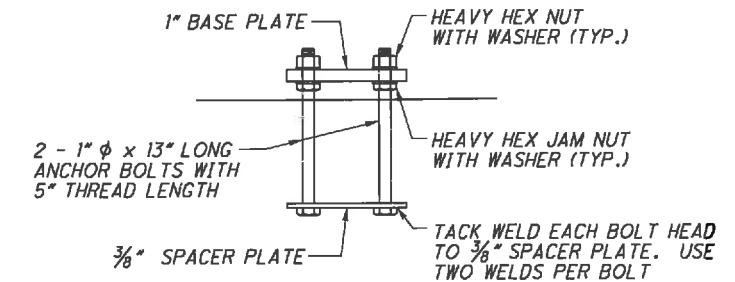


RAILING ELEVATION ON CONCRETE SLAB

BRIDGE TERMINAL ASSEMBLY NOT SHOWN. REFER TO STANDARD CONSTRUCTION DRAWING MGS-3.1 FOR DETAILS.

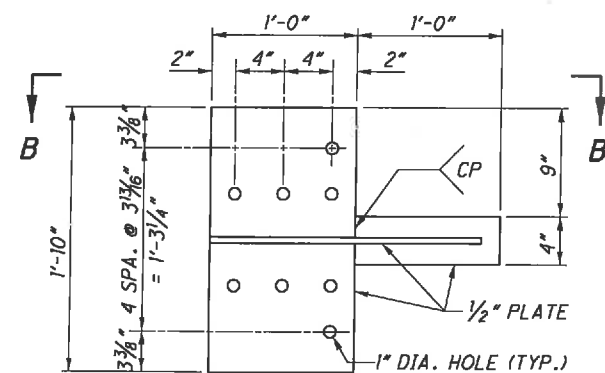
FOR SECTION A-A SEE SHEET 2/4.

- *** - PLACE THE CONCRETE ABOVE THE CONSTRUCTION JOINT AFTER INSTALLATION OF THE RAILING IS COMPLETE.
- **** - IN LIEU OF PROVIDING THE WINGWALL CONSTRUCTION JOINT, THE CONTRACTOR MAY FIELD DRILL HOLES IN THE TUBING FOR POST-TO-TUBE RAIL CONNECTIONS AT ALL FLUSH MOUNTED POST LOCATIONS. REPAIR GALVANIZING ACCORDING TO C&MS 711.02.

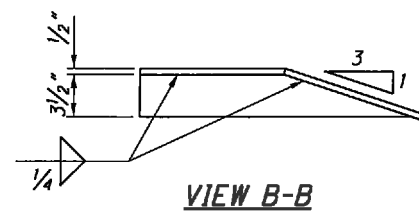


FLUSH MOUNTED POST ANCHOR DETAIL

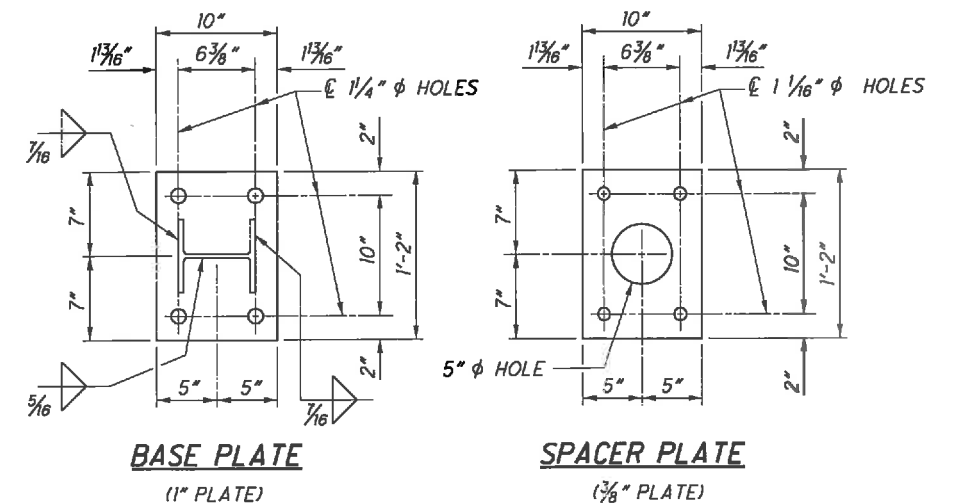
(POST NOT SHOWN)



GUARDRAIL CONNECTION PLATE DETAILS

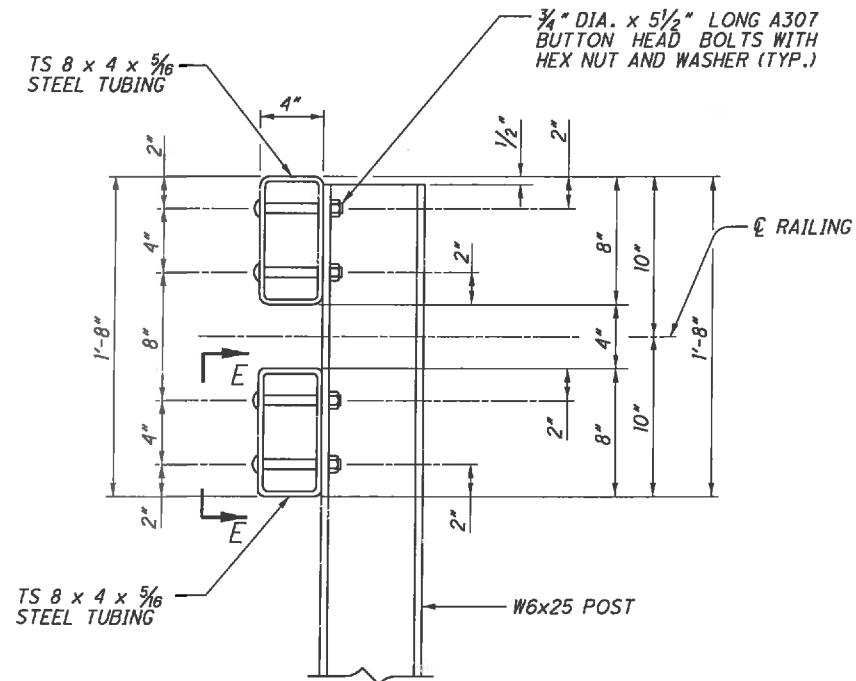


VIEW B-B

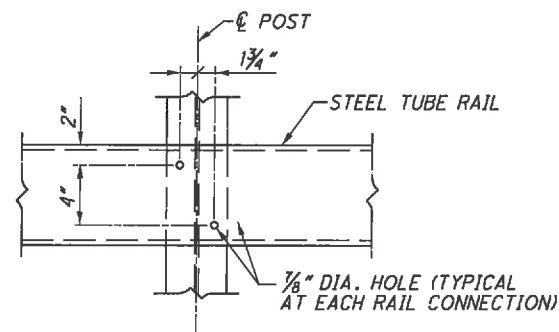


BASE PLATE
(1" PLATE)

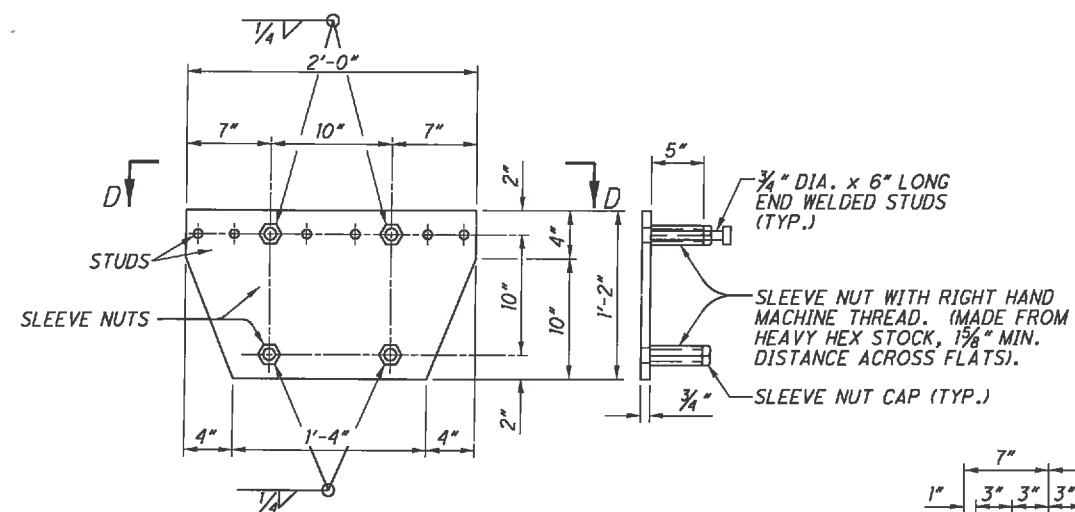
SPACER PLATE
(3/8" PLATE)



RAILING CONNECTION DETAIL



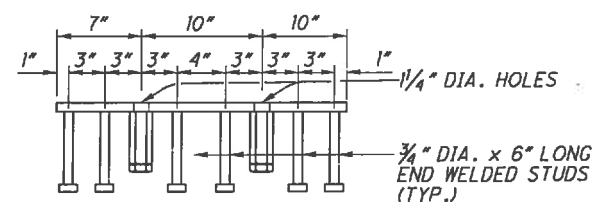
VIEW E-E



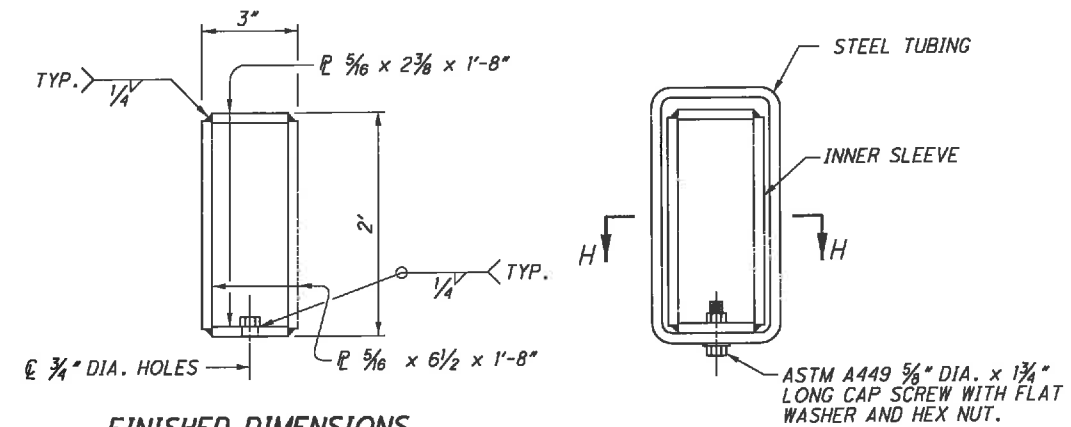
ELEVATION

END VIEW

POST ANCHOR DEVICE

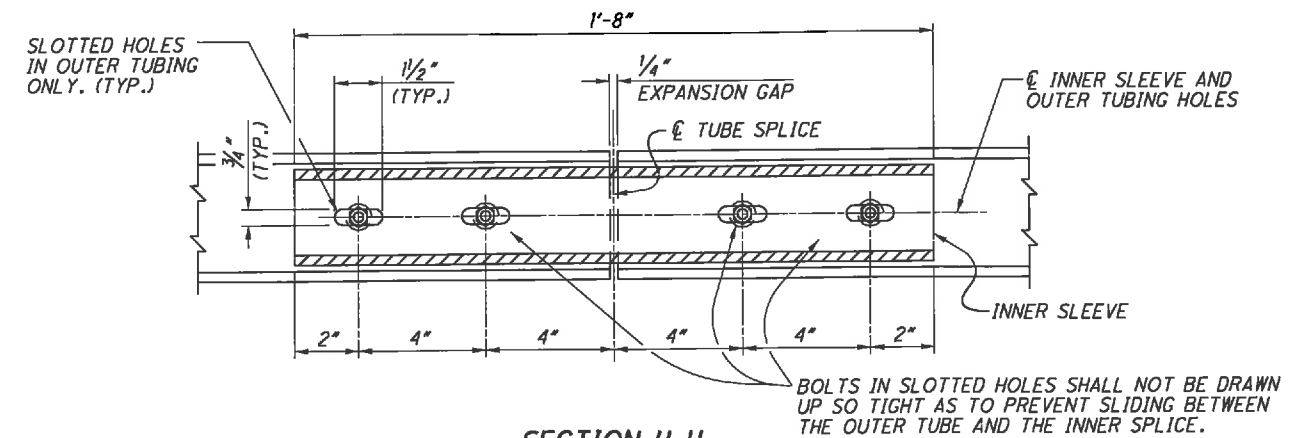


VIEW D-D



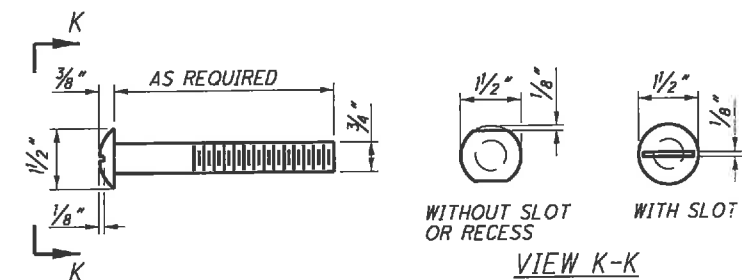
FINISHED DIMENSIONS OF INNER SLEEVE

SECTION THRU SPLICE

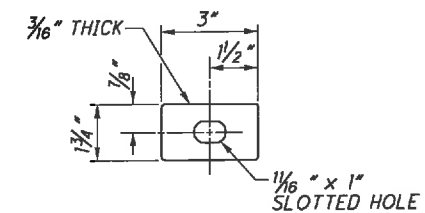


SECTION H-H

STEEL TUBE SPLICE DETAILS



DETAIL OF $\frac{3}{4}$ " DIA. ROUND HEAD BOLT



SPECIAL WASHER

PLACE WASHER BETWEEN BOLT HEAD AND FACE OF THRIE BEAM RAIL.

TST-1-99 GENERAL NOTES:

GENERAL: THIS DRAWING PROVIDES DESIGN AND CONSTRUCTION DETAILS. THE PROJECT PLANS FOR EACH STRUCTURE SHALL PROVIDE NECESSARY ADDITIONAL RAILING DIMENSIONS INCLUDING RAILING LENGTHS, POST SPACINGS, POST LENGTHS AND ANY OTHER PERTINENT INFORMATION INCLUDING SPECIAL NOTES AND DETAILS. FOR ADDITIONAL GUARDRAIL DETAILS, SEE STD. CONSTR. DWGS. MGS-1.1, MGS-2.1 AND OTHER DRAWINGS PERTAINING TO DESIGN OF SPECIFIC GUARDRAIL TYPES.

APPLICATION: THIS RAILING SYSTEM HAS BEEN ACCEPTED TO THE TL-4 CRITERIA OF NCHRP REPORT 350. THE TWIN STEEL TUBE RAILING SHALL BE USED ON STRUCTURES DESIGNED TO DRAIN SURFACE WATER OVER THE SIDES OF THE STRUCTURE. THIS RAILING IS NOT APPLICABLE TO COMPOSITE BOX BEAM BRIDGES WITH DESIGN OVERHANGS GREATER THAN 2" OR TOP FLANGE THICKNESSES LESS THAN 5".

CONNECT THE APPROACH AND TRAILING ENDS OF THE TWIN STEEL TUBE RAILING TO THE BRIDGE TERMINAL ASSEMBLY DETAILED IN STANDARD CONSTRUCTION DRAWING MGS-3.1. THE FIRST POST AT THE APPROACH END AND THE LAST POST AT THE TRAILING END OF THE BRIDGE RAILING SHALL BE FLUSH MOUNTED AS SHOWN ON SHEET 1 OF 4.

DESIGN DATA:

REINFORCING STEEL - MINIMUM YIELD STRENGTH = 60,000 PSI
STEEL TUBING - MINIMUM YIELD STRENGTH = 46,000 PSI
ALL OTHER STEEL - MINIMUM YIELD STRENGTH = 50,000 PSI

MATERIALS: FURNISH SHAPED STRUCTURAL TUBING ACCORDING TO 707.10 (ASTM A500, GRADE B). IN LIEU OF THE "DROP WEIGHT TEAR TEST" (ASTM E436), THE MANUFACTURER MAY CHOOSE TO SUPPLY TUBING THAT MEETS IMPACT TOUGHNESS ACCORDING TO AASHTO T266, "NOTCHED BAR IMPACT TESTING OF METALLIC MATERIALS (CVN)". THE CVN IMPACT REQUIREMENTS SHALL BE 15 FT-LBS AT 0°F. FOR EACH HEAT SUPPLIED, THE MANUFACTURER SHALL FURNISH ONE 2" x 18" SPECIMEN, MARKED WITH ITS HEAT NUMBER, FOR IMPACT TESTING.

FURNISH STRUCTURAL STEEL SHAPES, PLATES AND PLATE WASHERS ACCORDING TO 711.01.

GALVANIZING: GALVANIZE ALL SHAPED STRUCTURAL TUBES, POSTS, PLATES, HARDWARE AND ACCESSORIES IN ACCORDANCE WITH 711.02. PRIOR TO GALVANIZING, ROUND ALL STRUCTURAL TUBING ENDS AND REMOVE BURRS FROM ALL STEEL TUBING, SHAPES AND PLATES.

HORIZONTAL CURVATURE: THIS STANDARD IS APPLICABLE TO STRUCTURES HAVING A RAILING CURVATURE RADIUS OF 20 FEET OR MORE. FOR A RADIUS OF LESS THAN 20 FEET, THE DESIGN SHALL BE SPECIAL. FOR ALL CURVED STRUCTURES, HEAT CURVE THE HORIZONTAL RAIL ELEMENTS ACCORDING TO THE AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS.

TUBE SPLICES: LOCATE SPLICES SO THAT EACH TUBE SEGMENT IS CONNECTED TO NOT LESS THAN TWO POSTS. STAGGER SPLICES IN THE TOP AND BOTTOM TUBES TO AVOID OCCURRENCES IN THE SAME PANEL.

FASTENERS: FURNISH MATERIAL CONFORMING TO THE FOLLOWING:

ALL ANCHOR BOLTS, SLEEVE NUTS, NUTS AND WASHERS SHALL CONFORM TO ASTM A 449.

END WELDED STUDS SHALL CONFORM TO ASTM A108.

THE TUBE RAIL TO POST CONNECTION BOLTS AND HEX NUTS SHALL CONFORM TO 711.10 (ASTM A307). REFER TO STANDARD CONSTRUCTION DRAWING MGS-3.1 FOR THE BRIDGE TERMINAL ASSEMBLY CONNECTION HARDWARE.

THE HEX CAP SCREWS (BOLTS), HEX NUTS AND WASHERS SHALL CONFORM TO ASTM A 449.

BOX BEAMS: THE DISTANCE FROM THE CENTERLINE OF A GUARDRAIL POST TO THE ABUTMENT END OF THE BEAM OR TO THE CENTERLINE OF A TIE ROD SHALL NOT BE LESS THAN 1'-8". THE DISTANCE FROM THE CENTERLINE OF A GUARDRAIL POST TO THE PIER END OF THE BEAM SHALL NOT BE LESS THAN 2'-10". THE LOCATION OF THE HORIZONTAL TIE RODS MAY NEED TO BE ADJUSTED IN ORDER TO ACCOMMODATE EACH POST ANCHOR DEVICE.

METHOD OF MEASUREMENT: THE DEPARTMENT WILL MEASURE TWIN STEEL TUBE BRIDGE RAILING BY THE NUMBER OF FEET. THE DEPARTMENT WILL MEASURE THE LENGTH OF RAILING AS THE DISTANCE BETWEEN THE CENTERS OF THE FLUSH MOUNTED POSTS AT THE APPROACH AND TRAILING ENDS PLUS 4'-11".

BASIS OF PAYMENT: THE DEPARTMENT WILL CONSIDER THE COSTS ASSOCIATED WITH FURNISHING AND INSTALLING STEEL TUBING, STEEL POSTS, POST ANCHOR DEVICES, ANCHOR PLATES, TUBE SPLICE PLATES, STEEL SHIM PLATES, GUARDRAIL CONNECTION PLATES, ANCHOR BOLTS, $\frac{3}{4}$ ROUND HEAD BOLTS, SLEEVE NUTS, NUTS, CAP SCREWS, WASHERS AND OTHER HARDWARE TO BE INCLUDED WITH THE TWIN STEEL TUBE RAILING. THE DEPARTMENT WILL PAY FOR ACCEPTED QUANTITIES AT THE CONTRACT PRICE FOR ITEM 517, RAILING (TWIN STEEL TUBE).

THE DEPARTMENT WILL PAY FOR BRIDGE TERMINAL ASSEMBLY
HARDWARE SEPARATELY.